AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

Entered at the Post Office at New York, N. Y., as Second-Class Matter.

VOL. 2, No. 11.] NEW YORK, SATURDAY, JULY 19, 1879. [$3.00 per Annum.

SINGLE COPIES, 6 CENTS.

Improved Automatic Cut-off Engine.

The claims of the parties who build the engine shown in our illustration are, that it gives all the economy and other advantages of this style of engine, without the expensive, and more or less complicated valve gear, used by other builders. It is also claimed to require as little skill in running, and is as easily kept in proper order as any plain slide-valve engine.

By referring to the illustration it will be noticed that there are two eccentrics and therefore two valves. The eccentric nearest the pillow block is connected to the main valve, which is the ordinary pattern—with this exception, that the steam instead of passing the edge of the valve, is taken through it, by means of the ports C and D shown in the small illustration.

H represents the back of the main valve, which is also the seat of the cut-off valve G. F represents the stem of the main valve, and B the stem of the cut-off, which is continued on through the end of the steam chest, and is held steady while the engine is working by means of a horn at A. The reader will notice that there is a rack cut in the back of the cut-off valve, which engages the teeth of a small gear on the valve-stem, and from this device will at once come to the conclusion that the adjustment of the cut-off is accomplished by rolling the valve stem. This, as a matter of course, will raise and lower the cut-off valve by means of the rack and pinion, thereby opening or closing the ports.

Directly under the governor there is a disc on the valve-stem with teeth cut on the periphery about half the circumference, and these teeth engage a rack connected with the governor spindle, consequently as the balls of the governor rise and fall, a proportional motion will be transmitted to the cut-off valve.

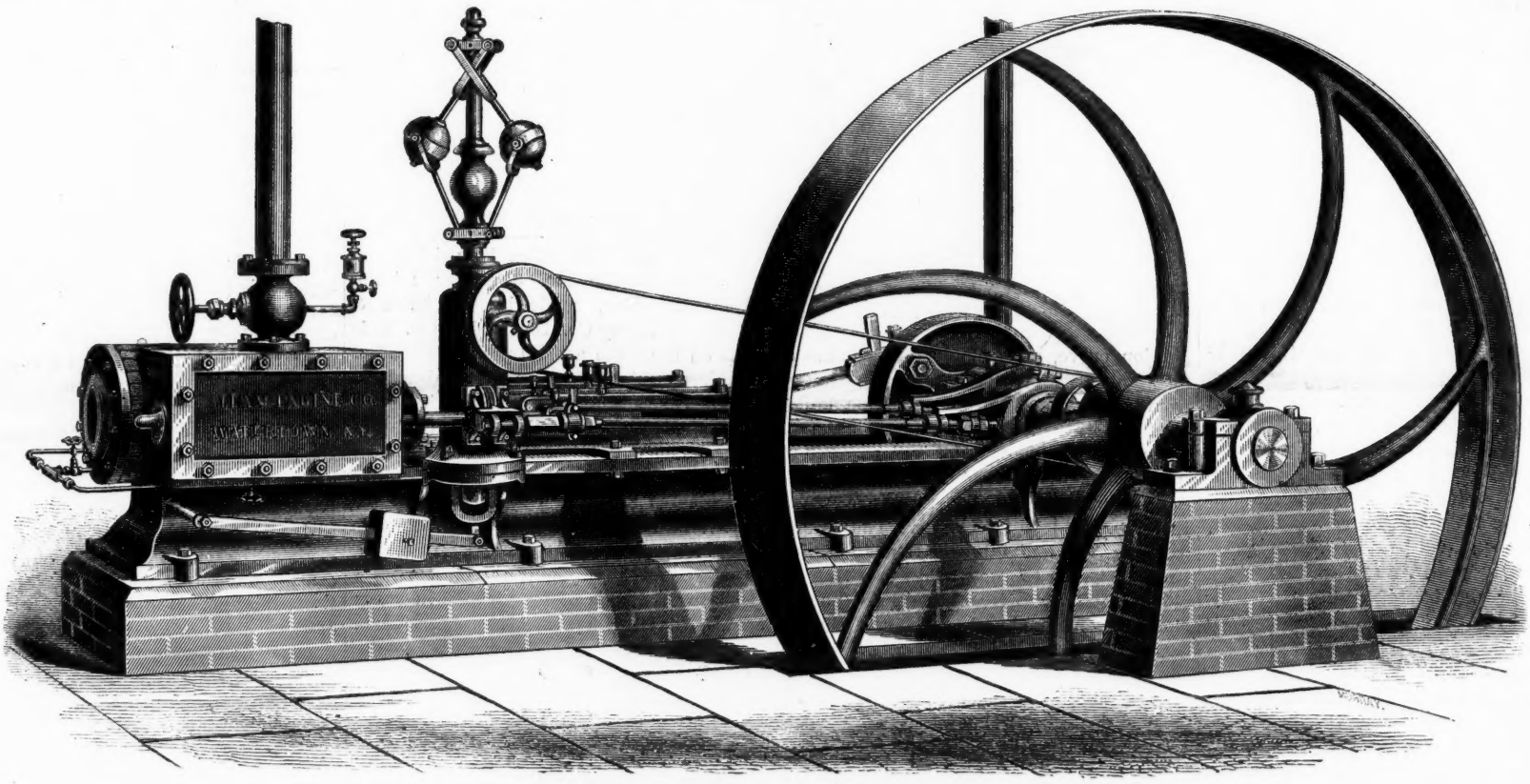
In order to make this motion positive and reliable at all times, an important improvement has been made in the manner of suspending the govenor balls. The point of suspension, instead of being on the same side of the spindle as the ball, is carried over to the opposite side, thereby greatly increasing the power and sensitiveness of the governor.

To determine the point at which the engine is cutting off while running, the plain part of the disc which is connected with the governor and valve-stem, has marks and figures upon it, each mark indicating a point in the length of the stroke There is a point which coincides with these marks, and can be seen in the illustration directly under the pulley attached to the governor. A glance at this device will show at once the point at which the cut-off takes place. To increase or diminish the speed a counter weight is attached to the end of the governor spindle, under the steam chest These engines are also built with a plain slide valve, and with cut-off adjustable by hand.

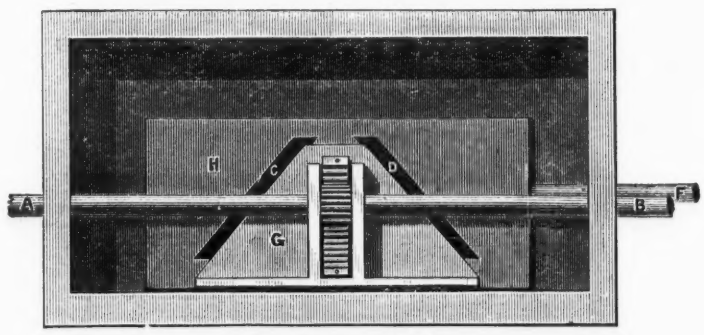
The bed plates are very solid, heavy, and substantial. The cylinder is jacketed to prevent radiation. The piston consists of three rings and springs. The piston-rod is screwed to the cross-head and secured by a jam-nut, admitting of adjustment at any time, as it wears.

The steam chest is full length of the cylinder, avoiding long and wasteful passages. The connecting rod is of forged iron, with composition boxes and straps, gibs and keys, accurately milled and fitted by special machinery. The crank shaft is wrought iron, running in long and heavy anti-friction metal bearings. The cylinders are made of the best car wheel iron, and as hard as can be worked and guarantee accuracy.

This engine is built by the Watertown Steam Engine Co., warehouse 91 Liberty St., New York, in charge of E. P. Hampson. They also build a new style of vertical steam engine shown in our second illustration.



Improved Automatic Cut-Off Steam Engine.



Plan of the Valve.

We also illustrate on the second page a small upright engine, built by the same company, which possesses the following improvements, viz., an improved balance piston valve, wherein there is a jacket covering the valve its whole length, and taking steam at the ends. It also possesses other advantages. Besides the improvement in the valve, the connections deserve something more than a passing notice.

It will be observed that the iron composing the frame is distributed so as to combine lightness with strength. The illustration represents a class of engine adapted to general use, but they are also constructed with a link motion thereby adapting them at once for use in steam yachts, where they are said to give satisfactory results. In the link motion of these engines there is a new device for reversing the motion and cutting off, positive in its operation and occupying the smallest space.

The workmanship of these engines is very fine, and is calculated to be ornamental as well as useful.

One of the most gratifying features of the times is gradual, yet sure, improvement of our iron and steel industries. This industry has suffered most severely during the late years of business depression, and even with a fair season of prosperity many millowners will be obliged to apply, for some time to come, a large part of their profits to liquidating the indebtedness incurred in the era of downward prices. But daylight has dawned unmistakably, and henceforth we may expect—not a period of easy prosperity, but a stable and substantial trade for the encouragement of honest labor and investors of solid capital. A few years ago a man would have been thought chimerical to predict that in a short time iron would sell as cheap from warehouses in New York as in London ; yet, if we mistake not, the price has even ruled cheaper on this side of the Atlantic than in the greatest iron producing country of the world. One great drawback to the profitable production of new iron has been the quantity of old iron rails upon the market. Lately these supplies have been growing scarce, and several mills that were run exclusively on that material have been obliged to start their puddling furnaces and use new iron. Considering the number of steel rails that have been laid, it is unlikely that old rails will again become the incubus upon the iron market that they have been. But the iron industry must be strongly progressive. Experienced iron masters are not slow to admit that the iron making plant of the future will be a *direct process*, producing both steel and

merchant iron immediately from the ore, without running into pigs or using furnaces for puddling. It may take many years to bring the direct process to a state of perfection, but recent experiments in this country show great progress in that direction.

The Indicator Diagram Not a Fraud.

Mr. Editor:

In the May number of the MACHINIST (your numerous readers are to be congratulated that it is not in order to say *the* May number of future publications), Mr. Roper, to whom we are all indebted for many good things, asks the question: Is the Indicator Diagram a Fraud? If an answer is in order, I should say most emphatically *no*.

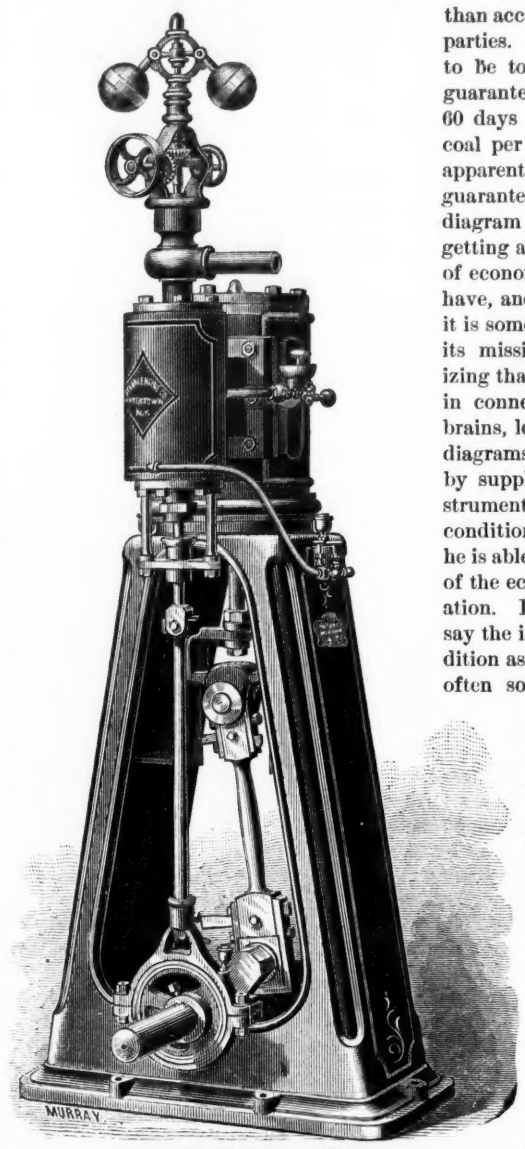
The indicator diagram, when the instrument is in order and properly applied, reveals to those who can correctly read it precisely what it is intended to reveal. The individual who handles the instrument may be a fraud; the diagram can never be. What then are the causes which go to discredit the story so graphically told by the diagram? Mr. R. specifies some of them as "doctored" diagrams, and indicator (?) diagrams drawn from templets, which is certainly an easy way to do it and saves all trouble in the way of cleaning and caring for the instrument. Perhaps this templet part of the business may be made to account for some of the impossible diagrams so frequently met with of late—apparently impossible, since no engineer, other than an interested party, ever succeeds in taking one from the same class of engines that will at all answer to compare with them. There is to the average engineer something suspicious in a diagram from an unjacketed cylinder, the expansion line of which coincides with the adiabatic curve. It would be entirely in accordance with good practice to look for something wrong about an engine making such a diagram. The writer has more than 1000 diagrams, taken from a variety of engines at piston speeds ranging from 50 feet per minute to the quickest speed of express locomotives, and when the clearance has been known so as to admit of drawing the theoretic curve, the expansion curve has never been found to fall below the hyperbola for its entire length, except in a few instances, when the diagram was interpreted as telling of a very leaky piston, and subsequent investigations demonstrated the fact that it was by no means a fraud,—in other words, it told the truth. Now, as there is a very material difference between the hyperbola and the adiabatic curve, I am forced, so far as my experience goes (and it may be remarked that this is the experience related by the best authorities), to the conclusion, that my diagram, which represents the expansion of ordinary saturated steam in an unjacketed cylinder on this last named curve, has been—well, selected for the occasion. Instances are by no means rare of engines being sold on data of this character to run on 2½ lbs. of coal, where the purchaser's coal account showed a consumption of 4 lbs., and I am sure Mr. R. will agree that the sins of the parties who sell on such representations ought not to be visited upon the indicator. If, as Mr. R. suggests, and there seems too much reason to believe, "doctored" diagrams are used for unworthy purposes, he should also remember, *they are not indicator diagrams in any sense of the word.* There are undoubtedly other causes which operate to render the actual diagram unreliable. The engineer who uses the instrument does not need to be told that it is a matter involving considerable skill and pains to know the instrument is in perfect working condition.

He will also recognize the fact, that it is sometimes an extremely difficult matter to get a motion for the paper drum that shall at all times exactly represent the motion of the piston,—in fact *absolute* perfection under ordinary conditions is unattainable with the best instrument in present use. Of course it is not intended to say that this may not be accomplished with sufficient accuracy to answer all practical purposes; but I feel sure of being sustained in the statement, that it rarely is done with the refinement necessary for determining such *exact* position of the expansion curve, as is claimed for the model diagram. The writer was shown letters from two prominent firms of engine builders, in reply to an inquiry for price of 40 horse-power engine and the coal required to run such an engine. The first parties replied, the consumption of coal would be about 1,400 lbs. per day of 10 hours. The second parties referred him to diagrams to demonstrate that their engine would run with from 2¼ lbs. to 2½ lbs. of coal per horse-power. Now the would-be purchaser being a shrewd business man, although not understanding all the ways of trade as applied to the steam engine, figured the least possible saving, by buying from the second parties, to be 400 lbs. of coal per day. As coal at his place was worth five dollars per ton this would amount to three hundred dollars per year, or ten per cent. on three thousand dollars.

Reasoning from these premises, he concluded it would be a better investment to buy from the second parties, rather even than accept an engine as a gift from the first parties. The best advice to give him seemed to be to buy from the first parties under a guarantee that their engine should run for 60 days at a consumption of 1,200 lbs. of coal per day—200 lbs. more than they had apparently asked for. He didn't get the guarantee nor the engine. If an indicator diagram will satisfy a purchaser that he is getting an engine that will run at an unheard-of economy, it is a very convenient thing to have, and there need be but little wonder if it is sometimes doctored, the better to fulfill its mission. The engineer, however, realizing that the indicator cannot reason, that, in connection with its use there must be brains, learns to place but little reliance upon diagrams he has not taken himself, when, by supplementing the story told by the instrument with such a knowledge of existing conditions as he ought to possess himself, he is able to judge with reasonable accuracy of the economy of the engine and consideration. It is quite proper (because true) to say the indicator is frequently in such a condition as to be wholly unreliable; that it is often so applied as to render the diagram worse than useless; that its indications are sometimes misinterpreted, or that more is claimed for it than ought to be; but it cannot be said that its correct indication is ever a fraud. To its use, more than any other one thing, the world is indebted for the steam engine of the present, and its periodical application always tends to the economic use of steam.

F. F. HEMENWAY,

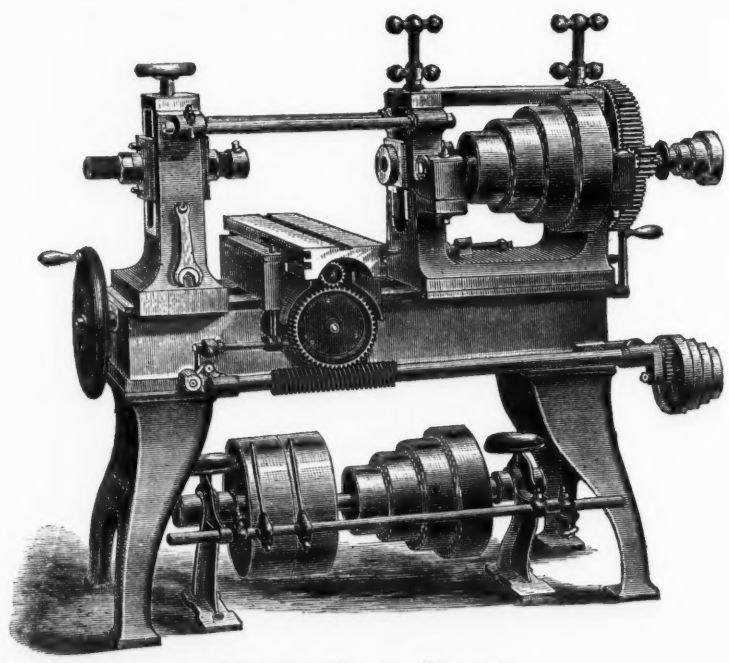
Troy, N. Y.



IMPROVED VERTICAL ENGINE.
(SEE FIRST PAGE.)

Improved Milling Machine.

The illustration herewith represents the No. 3 power milling machine, made by the Pratt & Whitney Co., Hartford, Conn. It is built on the same general plan as the other machines which they have furnished to armories and sewing machine factories in the U. S. and Europe to the number of two thousand. This machine is suitable for making the heaviest cuts on gun parts, and is well adapted for general milling in machine shops. It is provided with an automatic screw feed and an automatic stop motion, adjustable at any point, a foot stock for steadying the ends of long arbors in heavy cuts, and a vise with permanent crank wrench.



IMPROVED MILLING MACHINE.

The head is furnished with back gears. The cone has four grades and carries a three inch belt. The feed cone has four changes of speed. The weight of the machine with countershaft is 2,150 pounds.

A Boston boarding-house mistress has just failed. Among her liabilities is a mortgage of $427 on machinery. She must have had a complete plant of hash-making machinery.

The Waste of Niagara.

The amount of water passing over Niagara Falls has been estimated at 100,000,000 tons per hour, and its perpendicular descent may be taken at 150 feet, without considering the rapids, which represent a further fall of 150 feet. The force represented by the principal fall alone amounts to 16,800 horse power, an amount which if it had to be produced by steam would necessitate an expenditure of not less than 266,000,000 tons of coal per annum, taking the consumption of coal at four pounds per horse power per hour. In other words, all the coal raised throughout the world would barely suffice to produce the amount of power that annually runs to waste in this wonderful fall.

Extracts from Chordal's Letters.

Mr. Editor:

* * * What is to be done with customers who want things on trial, and what is to be done with parties who want to sell us stuff on trial? Some classes of trade have arrived at that stage where all sales are subject to trial. Printers not only don't pay for their machines, but they don't order them till they have tried them a month.

The whole thing is wrong. It has its base in the fact, that Tom or Dick, after getting up some new and really valuable machine, goes to making it, instead of putting it into the hands of some reputable manufacturers already established. As a consequence, purchasers are met by a hundred irresponsible manufacturers offering their wares. The wares are what are wanted if they will act as represented; but the trouble is that no confidence can be placed in the representation. If a man gets up a good machine, and takes it to a concern engaged in the manufacture of that line of machines, he can most always receive fair treatment. If the machine is apparently good, and wanted, the manufacturers will work it up to a success as a machine, and will put it on the market as a first-class rig, with their name on it. Ten per cent. on the gross receipts is a fair and proper royalty on machines, and as far as the manufacturer's profit, which these mushrooms ache over is concerned, bless them, there ain't any. I can go to five hundred manufacturing shops in the country, contract to deliver their machines five per cent. less, and twenty per cent. better than they are building them; can go and sublet the job to real manufacturers, and pocket more money than twenty of the small concerns make. And more than that, not a miller, or printer, or a thresher, or bookbinder, will ever dare to ask for thirty days or thirty minutes trial before ordering. Imagine Wm. Sellers & Co.; the Pratt & Whitney Co.; Hughes & Kimber; Jno. T. Noye & Son, or George H. Corliss, shipping stuff subject to order, if satisfactory after trial. Such men don't experiment at the cost of the customer, and don't put their name on machines not known to be about what is required. The customer is thus protected against good things put upon the market prematurely. Another feature is, that trial machines never get a trial. A man without money-interest in a machine will not investigate enough to develop the good there is in a thing. The first mishap condemns the whole thing, and it is returned as a failure, while real money-interest would refuse to believe that a machine was not capable of doing what it was designed for.

Wyckoff had a dozen governors sent on trial. They came. He unboxed one, and told the boys to put her on and see about it. They did, and saw that the pulley came out too far to be in line with the pulley on the engine-shaft. They took it off and threw it under a bench. The maker of these governors can correspond with W. till doomsday, and never get any satisfaction. When he orders the governors returned, he will get them, and will wonder what kind of a governor trial that is which never lets steam into the governor. If W. had money in those governors, it would have been on judgment, and they would have had a fair show.

If the governors had had a responsible man's name on them, W. would not have abused an offer, for he would not have had

it. Inventors should be protected as well as purchasers.

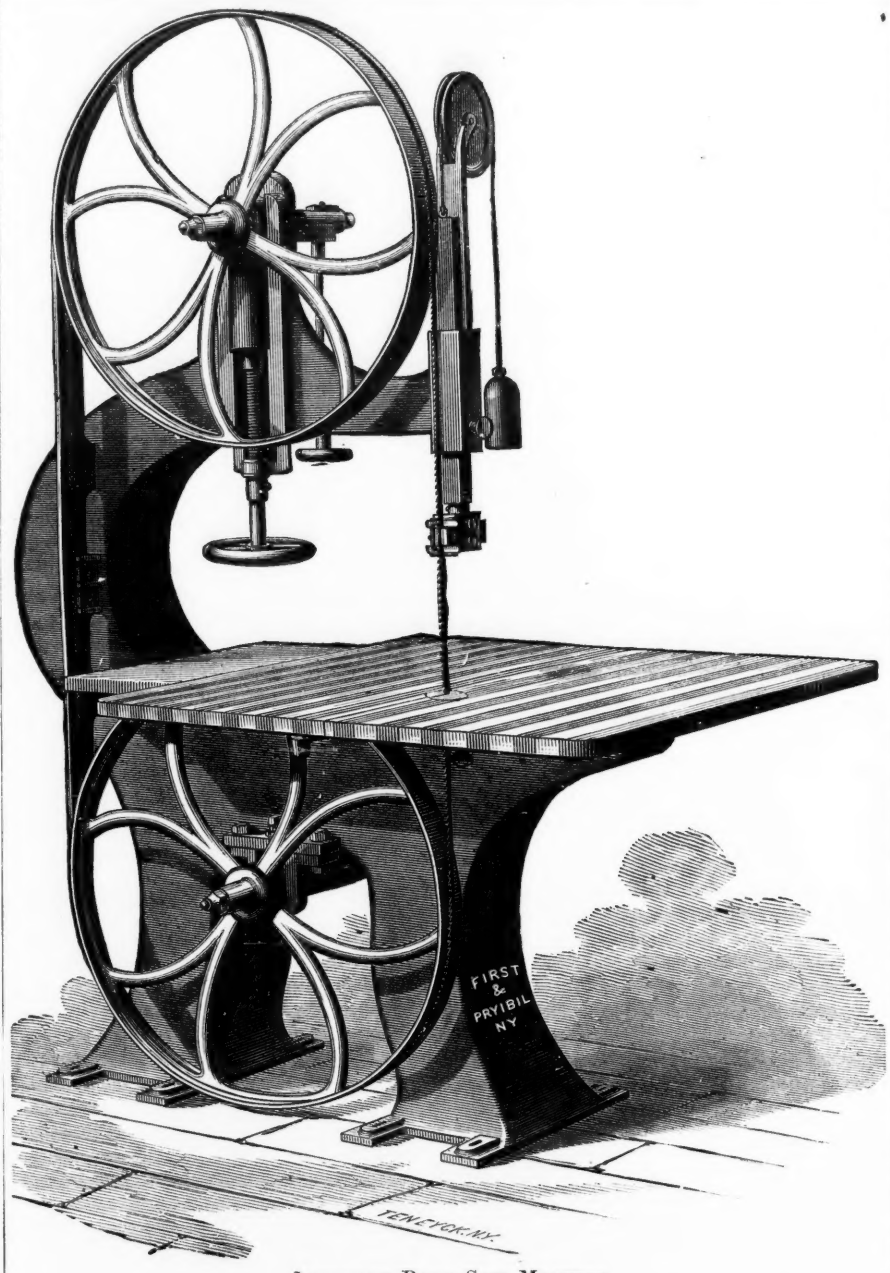
* * * There's no joke about a good many machine men paying themselves more for their product than others would charge.

If the future of a product is established, and if the projectors have plenty of money, there is no doubt but what prudence would suggest the starting of a factory arranged expressly for the specialty in hand. Such investments of cash and skill are wise, if the business is known to be permanent. But in many cases a party finds himself the proprietor of a device, which, by testing the market, he has found to be in demand. He has but ten or fifteen thousand dollars in the world, and is a man whose services are in demand in certain branches. What shall he do with his immortal invention? He can take it into certain localities, where manufacture has run in that line, and can contract to have the thing built in shops equipped with a world of special tools adapted to the line, with corps of workmen skilled in that line; and with market facilities of years of growth. He gets his machines without investing a cent in manufacturing facilities. He gets them made to specification and runs no risk. If he sees fit to work the market himself he has his whole means as a working capital, and when his device gives way to something newer or better, he quits, with his profits in cash, and his manufacturers are where they started; that is they have made a profit, and have the same plant they commenced with.

The other way for our man to go at the thing, is to start a shop. Work close financially, and work like a major every day, and use up three years' time getting his system of manufacture reduced to a science, and then his money is gone, and he is ready for the market, and some later thing has been in the market six months. It is certainly a fact, that it takes three years to organize a factory so a thing can be made as economically as a well-organized concern already existing can make it. Our man's small pile of money won't touch such a thing, and he has to let outsiders in to share the profits which he might have had himself if he had let the factory project alone. He can contract for his stuff, go into the market at once, and come out winner, and quit long before a factory can get ready to build a thing not wanted when it is ready. The factory project must certainly start from a desire to get the manufacturer's as well as the factor's profit; but I think, that in a great many cases, the enormous expense of organization will by far overbalance that little thing we call manufacturer's profit, a thing that in many cases you can stick in your eye without damage to the eye. And besides that, the manufacturer involves a host of officers to share the profit if it ever comes. The question is: Is the real party's net gain as much under a manufacturing system as under a contract system? It's a big lot of work which he must do for nothing, and in a few short years there is one more idle concern and a hundred employees idle, who have been seduced into a shop which never ought to have been started.

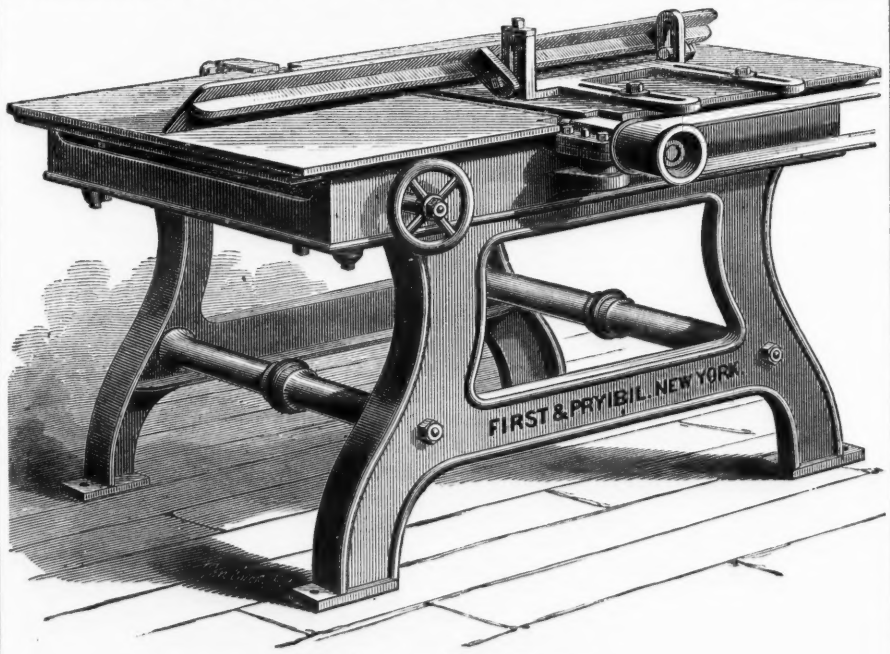
* * * There is a vast amount of valuable experience among the readers of the AMERICAN MACHINIST, and if any word of mine shall tend to call its possessors forward, I shall feel that I have been of service indeed. I am anxious to hear something about, or all about, pay systems for the shop. If Jones has twenty men he has no trouble in keeping time and paying off. The common stationer's time-book answers every purpose, but he must keep a ledger account with each man. I will refer to the system most in use, and, perhaps, this reference will result in bringing other plans to the front. I do not refer to any cost accounts, but simply to the time and pay accounts of labor.

A man goes to work and we wish to know how we can best keep his accounts, if he is one of five hundred men. The commonest plan is for a foreman or time-keeper to check the man on entrance to the premises, check again if he leaves before regular time, total the thing each week and enter the totals in a pay roll, which is receipted each pay day. The objections are, that it makes lots of work,



IMPROVED BAND SAW MACHINE.

it is difficult to correct errors, it keeps men too late at pay, and asks a man to sign a thing without time to figure it. Another plan is to take up time in a time-book ruled so as to work up directly into a pay roll and receive the payee's signature. Same objections. Still another is to give each man a pay-book ruled for days, rate of pay, balance at last pay, and amount due this pay. The books are turned in before pay day, calculated and returned to the man with check or cash enclosed. This is the best I have ever seen, for it puts a man on his honor, and saves all work and avoids all error. The only pay-book kept in the office is a "balance due" account. Attempts to pay from the regular job books are bound to destroy the accuracy of pay rolls or job cost accounts. Receipts from men on a book pay roll are of no value in court, and consume time. The time being known, a good way to pay is to enclose cash in an envelope, with a receipt to be signed at home and returned next day. Such a receipt will pass a jury. If it is not customary to pay cash in full, a due bill in full should also be enclosed, and the receipt should be an itemized receipt *in full* to pay day. Stubs in the due-bill book show balance due labor on pay day. Instead of the individual book referred to above, a bill system may take its place and have some advantages. This consists in furnishing men with blanks in this form:



NEW BUZZ OR HAND PLANER.

"JUNE 26th, 1879.

"*To the Erie City Iron Works.*

"I certify, that since last bill was rendered, I have worked 54 hours for you up to quitting time to-day. This at 30 cents per hour, $16.20. GEORGE W. THOMPSON.

"*Received Payment,*

"GEORGE W. THOMPSON."

The above bill is simply paid and charged to labor.

The best thing about this plan is, that you only have to pay Thompson for the time he works. He never will certify to a false bill without being kicked out of the shop by the other men. Men will delight, however, in picking you up on any plan which presumes on their dishonesty, and seeks to guard against it. The above is the Government plan of paying army officers, and is found to add much to the morals of the class.

Yours respectfully,

CHORDAL.

Improved Wood Working Machines.

The superiority of American wood-working machinery, both in design and quality of workmanship, was sooner recognized abroad than the peculiar merits of our machine tools. As a result, our manufacturers of wood-working machinery are finding a profitable market for their productions in many countries, where but little trade has been developed in iron cutting tools. This has stimulated improvements to a degree that never would have been reached with the sole dependence on a home market, and renders it probable that America will always keep ahead in the perfection of wood-working machines. We present on this page views of two excellent machines, one for sawing and the other for planing, both manufactured by P. Pryibil (successor to First & Pryibil), 461 West 40th St., New York. The first illustration represents an improved form of their well-known band-sawing machine (No. 2.) The frame of this machine is what is known as a box frame, and possesses extra strength in proportion to its weight and size. The lower bearing is fixed and the upper one adjustable for the saw tension. The saw is guided back and front, the latter being adjustable by a single set screw, which is entirely reliable because the guide is counterweighted, as shown. This plan of counterbalancing the adjustable guide is a special advantage, greatly facilitating the adjustment, which may be made with one hand. The saws are not liable to break, owing to an improved patent slide-bearing which adjusts itself according to the expansion or contraction of the saw. It guides the blade immediately above and below the work, also at the back of the table near the frame. The pulley wheels are very carefully balanced, which insures steadiness in the running of the saw. The saws can be run at high speed with entire safety, owing to the skillful combination of materials in the elastic portion of the saw.

To regulate the tension of the saw blade the upper bearing is in a box sliding in guides and adjustable by means of the band wheel and screw. The wheels are 40 inches in diameter, the sawing space 15 inches. The machine weighs 1600 pounds. Its total height is 8 feet, 9 inches; depth, 6 feet; width, 3 feet. The speed should be 350 to 375 revolutions per minute.

The second illustration shows a new buzz or hand planer, which is a great labor-saving machine, and is adapted to a very wide range of work. It is particularly adapted to prepare work for glue joints of any length or at any angle, and it is claimed, will perform about eight times the quantity, and a far superior quality of work to that possible by hand labor. It is also adapted to squaring, leveling, smoothing, tongueing and grooving, and planing out of wind. It will take the place of a Daniel's Planer on light work, and accomplish the same work in half the time. Furniture, chair, carriage and wagon and car builders, also piano makers find this machine well suited to their requirements. It is built in a substantial manner, entirely of iron and steel, and is heavier than most other similar machines of its size. The opening for the cutters is very small. The front table is adjustable to regulate the depth of the cut, and the machine can be so adjusted as to plane a little hollow. Each machine has an adjustable gauge for either square or miter work.

For further particulars apply to the manufacturer as above.

The Expert.

BY STEPHEN ROPER, ENGINEER.

The "expert," though a growth of recent origin, has become, as though it were, an institution among us, and that his calling is not recognized as a profession is none of his fault, as he advertises himself liberally, and leaves no stone unturned to make himself known individually. He is not always a man of extraordinary intellect or mechanical genius, though in this, as in other pursuits, there are honorable exceptions—men of rare ability; but it is the average "expert," who would have you understand that his stock of knowledge embraces all branches of mechanics and the mechanical arts, that we intend to make the subject of this article. As according to his own statement, in a majority of cases, the latest and most important improvement in any labor-saving machine is an old thing that he got up years ago, but did not consider of sufficient importance to patent; if you will step into his office some day, he will show you the model.

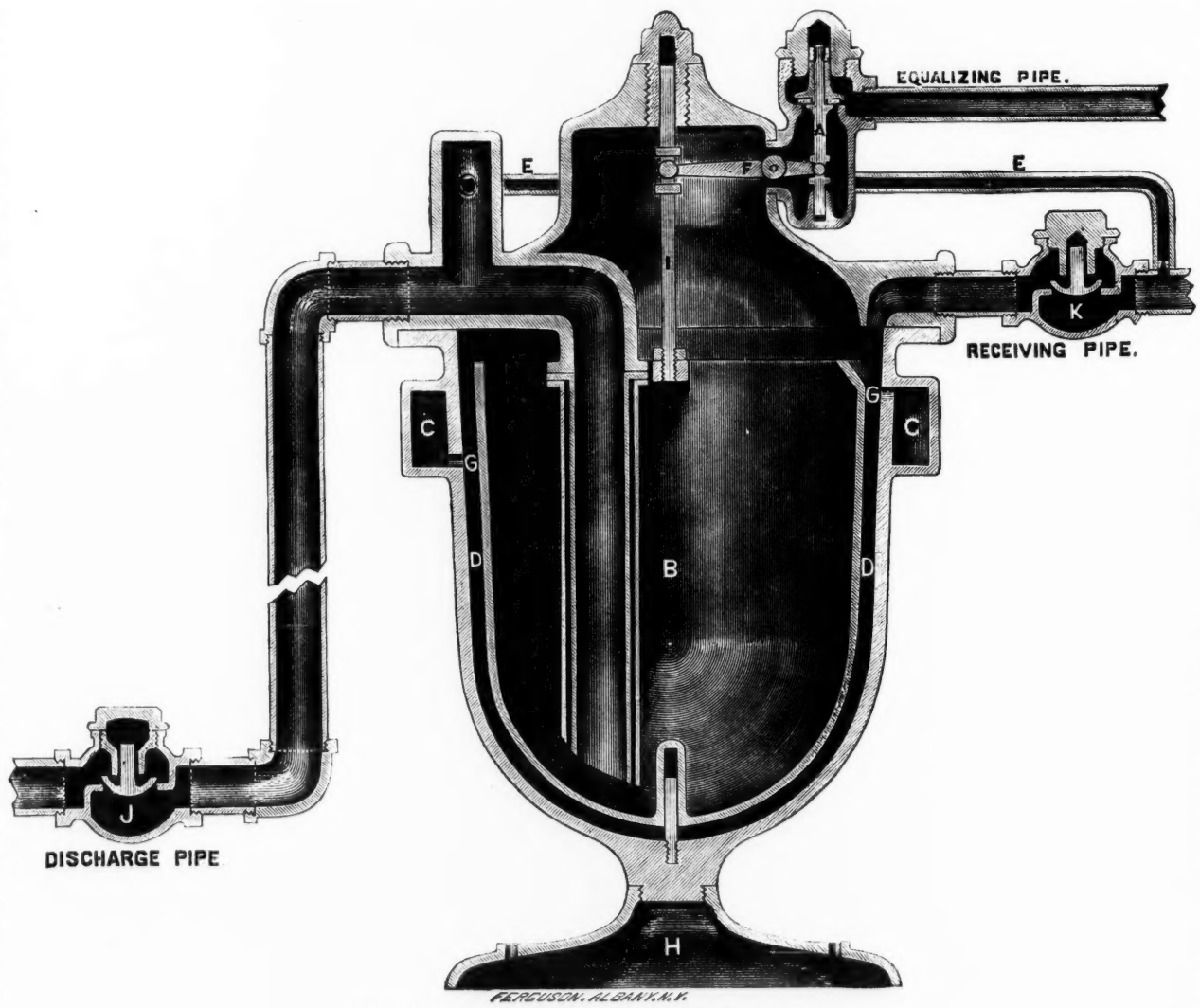
If you call the expert's attention to any intended improvement in any machine or steam engine, he shrewdly shakes his head as a warning not to attempt it, simply for the reason that he is opposed to anything that has not originated with himself. If his advice be asked on any knotty mechanical problem, he frequently consults his watch and discovers that he has an engagement at his office or some other place, just at that time; and when afterwards told that the thing was successfully unraveled by others, and found to be practicable, he exclaims, "Just my idea, exactly!" and propounds the query, "Did I not tell you so?" When requested to suggest an improvement in a complicated machine, he frequently places his head between his hands to relieve the racking pain to which his brain is exposed, and actually groans with the weight of responsibility that society places on his shoulders, and the incessant strain to which the mechanical world subjects his intellect. No class of persons are so shy in expressing a bold, confident opinion as the "average expert." He seems to feel as if he was hardly ever master of the situation, and that he is treading on slippery ground. This, perhaps, arises from the fact that he entertains the idea that some member of his own "ilk" will come forward and refute his calculations and theories; he is, therefore, in many instances, provokingly shy in stating what he honestly means, and is loth to express himself openly and above board.

The average expert is a chronic witness, not only before coroners' juries, but in State, District, and U. S. Courts. Of course, all the cases in which he testified were of great importance, and their decision hinged on his testimony, as they were invariably decided in favor of the party who employed him. A portion of his self-imposed duties is to indicate the horse-power of steam engines, and make an analysis of diagrams; though this latter he frequently declines to do, especially if he thinks his analysis is to be subjected to a close criticism, since, according to his own statement, in consequence of the multiplicity of his engagements, he has long ago allowed younger members of the profession to monopolize that branch of his business. No class of men, of the same calling, place so low an estimate on each other's individual talents, as experts; they never fail to inveigh against, or sneer at each other's capabilities, whenever they can find an opportunity. As a result, they hardly ever "hunt in pairs," each preferring to pursue his own devious course.

While the talented expert has undoubtedly done much towards the perfection of the steam engine, by making engineers and steam users better acquainted with the advantages of the indicator; the average expert has contributed liberally to counteract the same effect and prevent its general application, inasmuch as the conclusions he arrived at were so notoriously incorrect, that steam users lost all faith in the reliability of the indicator, instead of repudiating the expert's conclusions. Deceived as to the condition of their engines, and the power they were exerting, they could see no return for the outlay they had made. The diagrams showing the workings of their engines were invariably unaccompanied by anything approaching a scientific analysis, showing the power exerted, and the quantity of water, and, consequently, of fuel consumed. There are several notorious experts in the city of Philadelphia, as in all other cities of any size, who are ever ready to apply the indicator to steam engines, and who think they fulfill all the requirements of their calling when they expose to the view of the owner certain tracings on slips of paper, which they inform him are indicator diagrams, and which, without a clear analysis, are about as intellegible to him as so many hieroglyphics on an Egyptian monument. The disappointment and distrust of those who employ them are heightened by the fact that no two of them hardly ever agree on the character of any set of diagrams; unless that, perhaps, they may have agreed beforehand to agree, however different their individual conclusions may have been, which, perhaps, with due deference, is very often the case.

A difficulty arose between the proprietor of a factory, in the neighborhood of Philadelphia, and his tenants, to whom he rented power, as to the amount that each was using; and, in order to arrive at some accurate conclusion, he invited two prominent experts to investigate the matter thoroughly, and report. After giving the subject attention for some time, they were unable to agree, and, in order to leave nothing undone in coming to an amicable understanding, the owner of the steam power suggested that they call in three other men of their own profession. The five experts indicated the engine separately, determined that the power which it was exerting ranged all the way from 30 to 60 horse, and after a wrangle extending over several months, they were unable to come to any other conclusion; consequently they were invited to send in their bills, as the proprietor became satisfied that there was no chance of their agreeing, and that he must eventually look to the law to settle the difficulty. When the case came up for adjudication, the judge suggested that it be left to the arbitration of three practical mechanics which turned out to be eminently satisfactory to all parties concerned, except the experts, who seemed very indignant at what they considered an infringement on their inalienable rights; as it deprived them of an opportunity of spreading themselves individually on the witness stand.

The stock subscriptions for a brush factory at Napanee, P. O., are complete.



SECTIONAL VIEW OF BUCKET RETURN STEAM TRAP.

The Bucket Return Steam Trap.

Every steam user has experienced the need of a practical method of returning, under pressure to the boiler, the water of condensation from steam pipes and the jackets of cylinders. Such a result is demanded alike by all the economies of power, fuel and time, and therefore should commend itself directly to the exchequer of every user of steam power.

The first practical contrivance for this purpose to come into general use was the gravitating return trap, invented by Mr. James H. Blessing, of Albany, N. Y. This device is well-known to the readers of the AMERICAN MACHINIST, its principle being to make the weight of the water of condensation counter-balance the weight at the opposite end of the lever, thus causing sufficient gravity-motion of the same, to work a device called the equalizing valve, which communicates with the boiler, establishes an equilibrium of pressure, and enables the water by its own weight to descend through the check valve from the gravitating sphere into the boiler.

The practical working of this device has been so satisfactory to the steam users who have tried it, that it has become necessary to adopt its general principle to cases that sometimes occur, where, from the limit of available space, it has been difficult to arrange the various pipes so as to secure sufficient freedom of movement.

To meet cases of this kind, Mr. Blessing has invented a steam trap, which, while it accomplishes all the work performed by the gravitating return trap, and is equally satisfactory as to its mode of action, and its *results*, is a *stationary* trap with rigid connections. This new invention is named the Bucket Return Trap, and is now for the first time introduced to the public, with the full assurance that, in addition to its other advantages, it will especially commend itself in the fact that the steam valves and the devices actuating it are enclosed wholly within the trap itself, obviating thereby the necessity of stuffing boxes and other like contrivances.

Like the device which it supplements, this trap automatically drains the water of condensation from heating coils, and returns the same to the boiler, whether the coils be above or below the water level in boiler, thus doing away with pumps and other mechanical devices for such purposes.

Both styles of the traps mentioned above are manufactured under various patents and reissues by the Albany Steam Trap Co., of Albany, N. Y., and are claiming the attention of engine owners in every part of the English-speaking world.

Supplying a real and universal want as they do, the market, of course, must necessarily be world-wide, affording another instance of the tribute paid to Yankee mechanical skill.

"Putty," says an exchange, "is now put up in one, two and three pound pasteboard boxes, which makes it nice shelf goods." This will make it convenient for manufacturers of cheap machinery and iron castings who require frequent putty supplies to plug up holes in the metal and smooth off rough places.

The Lobdell Car Wheel Company of Wilmington are building a large addition to their already extensive works.

Available Heat of Combustion.

We take the following from "A Practical Treatise on the Combustion of Coal" by Wm. M. Barr, a recent work which was reviewed in our issue of June 28th:

"The *available* heat of combustion, of one pound of a given sort of fuel, is that part of the total heat of combustion which is communicated to the body to heat which the fuel is burned; for example, to the water in a steam boiler.

"The *efficiency of a furnace*, for a given sort of fuel, is the proportion which the available heat bears to the total heat, when the given sort of fuel is burned in the given furnace.

"The word 'furnace' is here to be understood to comprehend, not merely the chamber in which the combustion takes place, but the whole apparatus for burning the fuel and transferring heat to the body to be heated, including ash-pit, air holes, flame chamber, flues, tubes, and heating surface of any kind, and chimney.

"The theoretical heat of any given fuel is

easily determined, its proximate or elementary analysis being known; but the actual available heat is not so easily arrived at, and can only be determined by a series of more or less elaborate experiments or trials in actual use. In steam boilers the efficiency of the furnace is measured by the pounds of water evaporated per pound of coal burned on the grate, under known conditions. This will always be found to be below the theoretical quantity, and may be accounted for in many ways.

"Heat, like water, or steam, must flow from a higher to a lower level in order to become available, and in this flow or transfer there is a loss, which is explained in the article on the dissipation of energy.

"There is a loss due to the radiation of heat from the sides of the furnace; this may be prevented in part by building hollow walls around the furnace.

"There is a loss in the use of cold instead of heated air for supplying the oxygen to the burning fuel. This may be remedied in part by forcing the air through the hollow space left between the two walls, as suggested in the preceding paragraph.

"There is a loss occasioned by the difference of temperature between the escaping gases and that of the atmosphere necessary to produce natural draft. This may be largely overcome by using a forced draft, and dispensing with a chimney altogether, except one sufficient to get rid of the noxious gases; in which case it will act as an outlet only, the gases being forced into the open air by a pressure behind them, and thus more heat may be abstracted from them than if the temperature were used for assisting the draft.

"There is a loss by the waste of unburned fuel passing off as smoke, and that falling through the grates into the ash-pit unconsumed.

"There is loss by imperfect combustion, that is, loss by the formation of carbonic oxide instead of carbonic acid.

"The consideration of each of these forms of loss has been undertaken elsewhere in this volume, and need not be repeated here. There is no method by which the efficiency of a furnace can be exactly determined, except by an experimental test in actual service.

"The quantity of water evaporated from and at 212° per pound of coal, varies in ordinary practice from six to ten pounds; ten pounds is considered a very fair evaporation, and is probably much above the average; this is about seventy-one per cent. of the theoretical, if we assume fourteen pounds as the average theoretical evaporation power of good coal and coke.

"With inferior coal the results would be far below this; the quality of the coal or coke used must be taken into account, as well as the construction of the furnace, and to obtain the highest results, the furnace should have its details arranged with special reference to the burning of a particular fuel, as may be found after a trial, the best and most economical arrangement for that fuel."

Progress in Lathe Building.

This is the age of machinery. If, as some believe, the engine lathe is the most important of machines, we should have better tools of this kind than is frequently met with. Some years ago western parties purchased a lathe made in "Old Mass." A 20-inch swing, 2-inch belt, front spindle bearing $1\frac{3}{4} \times 2\frac{1}{2}$, rack cast and left in the rough, short carriage and small ways. This was said to be first-class. There are too many like it, as many workmen know.

At the Centennial there was, in some respects, a fine 16-inch lathe, with only $\frac{5}{16}$ inch bearing on each side of carriage-ways, with small spindle and narrow cone. Now these are serious defects, though not all; and the wonder is, so many are tolerated in this age of boasted mechanical progress.

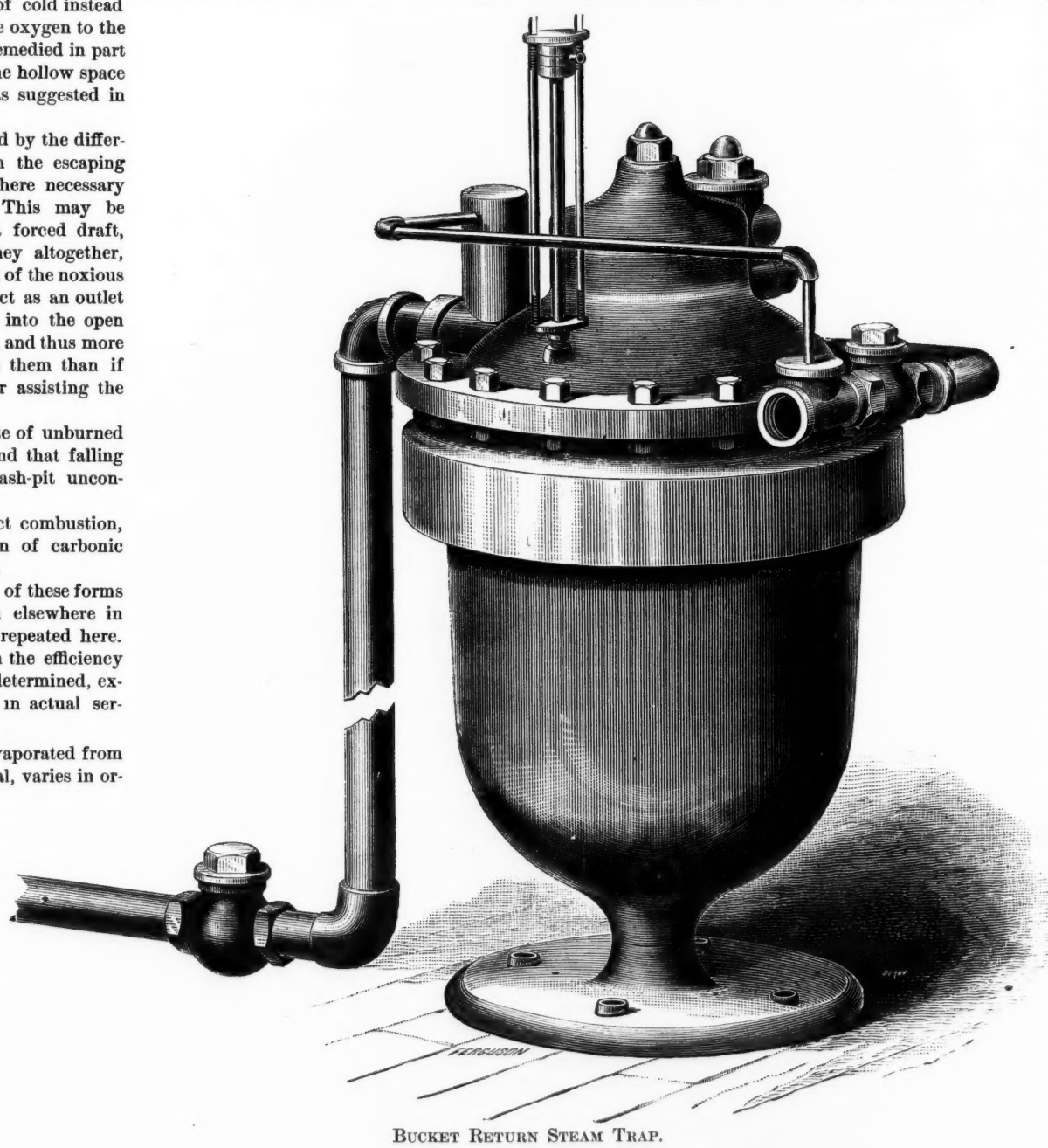
A real machinist can almost love a good lathe, but it must have as many as possible of the good points. The live spindle bearings should be large and long, wide cone, long and wide bearing surfaces to carriage, stiffness under heavy work, simplicity of parts, good material, convenience of handling, and accurate workmanship. If to these we add, ease of keeping clean, and neatness of design, we shall have a tool to admire—something to stimulate our skill, as well as a machine for real and profitable service.

Some of our tools of this class are really fine specimens of what a lathe ought to be. But our machine tool builders will hardly be wise if they stop improvements. For instance, Can't they produce a machine that will not catch and hold so much dirt and grit, which is bad for the machine as well as the workman, and bad for the owner? Can't the front bearing to spindle be so constructed that it will not so soon wear out of line? Would it not be well to make the wearing surfaces to carriage longer and wider? to give stiffness without clumsiness, and all the needed motions with fewer parts? Not much more outside finish, but thoroughly good work on all vital wearing parts.

It may be that we have beat the world on machinery. If so, there is cause for some pride, but none whatever for stopping—rather the more cause for greater effort, more thought, and finer skill. Our tools need to be better in all possible ways that our work may be better. The engine lathe is the king of tools.

H. NORTON,
Bernardstown, Mass.

The carriage builders at Amesbury, Mass., have larger demands for best grade of work now than for five years past. A large per cent. of them are running on orders, and there is demand for good workmen.



BUCKET RETURN STEAM TRAP.

Tires and Springs.

We find the following practical information in regard to carriage tires and springs in a late issue of the *Carriage Monthly* in answer to some of its correspondents:

"First, make the tire perfectly straight by drawing (*cold*) on the flat portion of the concaved or curved side, next to the edge, and never straighten by hammering on the edge. Next, remove all winds or twists by using the vise and twisting wrench. Next, be careful to have the rolls or bender so adjusted as to have the circle of the tire smaller than the wheel, increasing the circle by pulling apart, *not hammering*. Scarf and rivet points, so as to avoid the slipping either way of the points. Weld and fit the part welded as to suit the precise shape of the wheel, which may be done by taking a piece of band iron and bending it on the edge, so as to suit shape of wheel, which apply to inner side of tire at the weld. Next, heat the tire to a uniform heat, not red hot, of about 800° or 900°, and apply to the wheel. Apply as little water as possible, and rap up lightly with small hammer. Next, stand the wheel up, and have the helper hold a wooden mallet with thick leather cover on the rim, raising the wheel just clear of the floor, and rap down the open places of the tire, which yields quite readily while warm. Next, face the rim even with the tire, and cool, not cold, leaving sufficient heat in the tire to absorb any dampness which may exist between the rim and the tire.

"An uneven heating of the tire, black hot in some places, and red hot in others, has a bad effect on the rim, the greater the heat the greater the expansion, and naturally the greater contraction on cooling. The red heat chars the wood, and forms a rigid seat for the tire at that point, which allows of no moving of the tire beyond the overheated portion to compensate for the contraction. Something has to yield, and in this instance the iron is the weaker agent, and has to succumb to the force applied by the tire in contraction, which causes that of which complaint is made.

"The cooling off of the tire to that extent which does not leave heat enough to absorb the dampness between the rim and tire, causes the rim to swell, and from the fact of its being able to yield but with the grain, the rim becomes checked, which, on re-drying, shows the split or check. Too great pains cannot be taken in the matter of tire-setting. The rolls should be of the most improved patterns; the flag or plate upon which the wheel rests while putting on the tires cannot be too true in shape on its face, but, if true, will allow the tire to remain perfectly true.

"Our correspondent's question relative to springs is very ambiguous, and does not permit of equal answer, as does the one on tires. We say ambiguous, because there are so many classes of vehicles which carry the weight mentioned, and yet are of such construction as to require totally different construction in springs. Presuming, from the section in which our correspondent does business, that the vehicle in question is a four-passenger rockaway, we would say for front springs two elliptics, steel, $1\frac{1}{2}$ inches wide, 36 inches long, 8 inches open; head or main plates of No. 2 steel; the next two plates of No. 3 steel, and the outer plates of No. 4 steel; or all the plates of No. 3 steel. The main plates being of a heavy grade of steel, being backed by lighter or reduced grades, retains sustaining capacity and improves elasticity, and also prevents, to a greater extent, the matter of fracture from collapse or recoil.

"For the back springs, use the three-fourth elliptic and cross-spring, 39 inches long, 9 inches open, and of the same grade of steel and number of plates as with the front spring, with this exception—if the cross spring be over 38 inches long, and not more than 40 inches, make the main plate and plate adjoining of No. 2 steel; the other or remaining plates of No. 3 steel. But if over 40 inches long, use five plates in cross-spring. Main plate No. 2 steel, secured, and third plate No. 3 steel; fourth plate No. 4 steel, and fifth plate No. 5 steel.

"These dimensions will be found equitable for vehicles of this class, calculated to carry four ordinary-sized persons, weighing from 150 to 175 pounds each, while a fifth person may be added without danger of breaking; or will carry three persons and give off a fair amount of elasticity, or enough to continue riding not unpleasant."

In the New York County Clerk's office lately, articles of incorporation were filed by the "New York Steam-power and Heating Company," the organization of which Gen. Spinola was the promoter. The incorporators, who are to be the trustees for the first year, are Henry F. Stebbins, Edward Pierrepont, Marshall O. Roberts, Edwin D. Morgan, Hugh J. Jewett, Robert Lenox Kennedy, Nelson M. Bickwith, and Henry F. Vail. The capital stock is $5,000,000, divided up into 50,000 shares, and the corporation is to be in existence fifty years. Its objects are to convey steam through the streets, to heat all the building, for cooking, heating of water in houses, for motive power, for clearing the streets of snow and ice, and other purposes where steam can be applied.

Cast Iron Car Wheels.

While the advantages of chilled cast-iron wheels for the use of car and engine service, their low first cost, simple form, homogeneousness and consequent non-liability to break under changing temperature seem to be generally admitted, one very forcible objection urged against them is their lack of uniformity in their durability. Although some wheels make a very high mileage, others manufactured at the same time, of the same pattern and iron, fail early and thus largely reduce the average mileage. In examining into the cause of this, our attention is drawn to the fact that about 20 per cent. of the car wheels, and from 30 to 40 per cent. of the engine wheels which fail, are condemned for what are known as "tread defects," or "chill failings," such as become "comby," developing "seams" and "shelling out."

Further careful observation reveals the fact, that the "comby" tread is caused by scoria or other impurities, which, entering the mold with the iron, float against the chill and become fixed in the tread. The "seams" or "cold cracks" are caused by a check in the flow of the metal into the mould, while the large surface of the plate is filling.

They generally occur at a point opposite where the plate joins the tread, and are frequently caused, in a measure, by the fluid metal having been allowed to become comparatively cool and sluggish. The "spoting" or "shelling out" is caused by what are known as "cold shot." As wheels are ordinarily cast, the metal poured directly from the ladle into the molds, fills up the hub part to the line where it flows into the brackets, and then passes in driblets by one bracket after another to the chill. The metal thus reaches the chill in several streams of different temperatures, and some of it, as it strikes the cold iron, chills into "cold shot," which become fixed in the tread without welding, or thoroughly amalgamating with the surrounding metal.

Of course the most highly chilling irons are the most liable to form "cold shot," and thus it happens that this defect is found most frequently in the wheels that have the deepest chill, and which, therefore, might otherwise have given the highest mileage.

Of wheels chilled sufficiently to run 50,000 miles, in ordinary service, probably not more than 10 per cent. are free from latent tread defects. Frequently they are never discovered, as the nature of the service has much to do with their development.

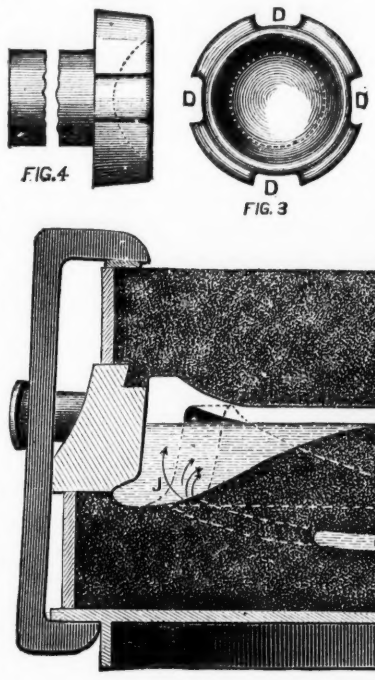
By referring to the accompanying illustrations, we will proceed to describe a new process by which the causes which produce the defects herein set forth are said to be avoided. Fig. 1 represents the section of a wheel mold, where it will be seen that the hub core A is formed with a concave top B, while the core seat C C is of convex shape, the center part being lower than the perimeter of the top of the core. Figs. 3 and 4 represent a side elevation and plan of the core A. There is a space between, which is formed by a core print (fig. 2) in the pattern. This space connects the receiving chamber E above with the mold by passage-ways D D, formed in the side of the top of the core. The combined area of these passage-ways is less than that of the conduit F from the receiving chamber.

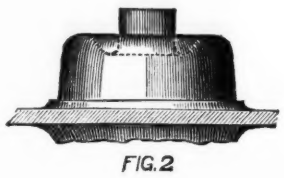
This simple device skims the molten metal of all impurities which rise and are retained in the receiving chamber. It also regulates the pressure and distribution of the metal within the mold.

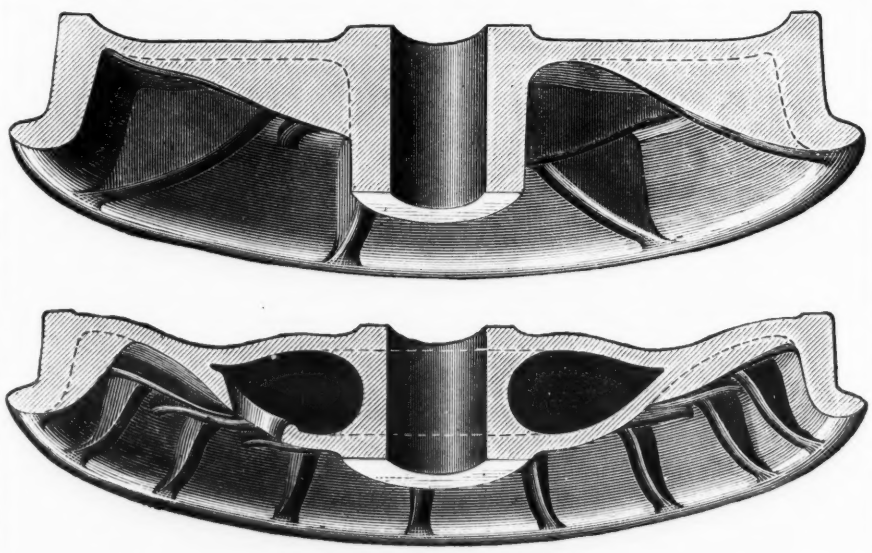
The metal upon entering the mold, first flows to the lower hub part at H,H, whence it is at once conveyed by the "sprue-ways," G,G, to the lower rim part at JJ. In passing into these "sprue-ways" it is again skimmed at their mouth. The rim of the wheel thus fills as rapidly as the hub, and the metal (not being allowed, as in ordinary practice, to cool in passing over the plates and through the brackets) reaches the chill at a very high but uniform temperature. The tread of the wheel fills so rapidly, and with such hot and pure metal, that "cold-shot" cannot form. And even should they form, they would be carried by the stream of metal to a point in the tread beyond the rail line. The uniformity in the temperature of the fluid metal, as it reaches the chill, causes the chill to expand equally, preserving its round form, and securing almost perfect roundness in the wheel. It also prevents "chill-cracking." It is claimed that wheels can be thus poured in from five to ten seconds, with iron as taken from the cupola, without a "chill-crack."

Fig. 5 represents a sectional view of a single-plate wheel, and Fig. 6 one of a double-plate. It will be observed that every alternate rib is connected with the rim of the wheel, and "runs off to nothing" near the hub. The ribs between these are attached to the hub, and diminish in width toward the rim.

This pattern of wheel, either single or double-plate, is so formed that no metal can reach the chill by way of the plates or brackets before the rim part of the wheel is full to a point beyond the rail intersection.







The brackets are so placed that one-half of them are filled through the "sprue-ways," by way of the rim, and brace the rim to the plate, and the other half are filled from the hub, and brace the plate to the hub. The plate is by this plan of brackets braced more securely than could be done in any other way with the same weight of metal.

The arrangement of the brackets, while giving greater strength of form, makes it impossible for any metal to reach the chill, except through the "sprue-ways," until the rim of the wheel has been fitted to a point beyond the line where in service the tread will intersect the rail. By these means the following results are claimed:

Round wheels, free from tread defects, from strain in the plates and checking in the brackets; a deeper chill in the tread, with softer plate and hub than have been made heretofore, and greater regularity, almost perfect uniformity in the depth of the chill, immunity from chill cracks, and consequent ability to pour the iron at a very much higher temperature than has been possible heretofore.

These wheels are manufactured by the Baltimore Car Wheel Co., Baltimore, Md. W. S. G. Baker, President.

Much discussion has been occasioned in New Haven by the reduction in the wages of city laborers from $1.50 to $1.25 a day. The feeling against it is so strong that it is thought the wages will be again placed at the old figure.

Gleanings from the Foreign Press.

AMERICAN VS ENGLISH WORKMEN.

We take the following from the *British Trade Journal*: "We cannot," it says, "call the competition of a country like America foreign competition, as it comes from an Anglo-Saxon nation of the same stock as ourselves; but, looking at it in a trade light, it is a foreign competition, and one of a very serious nature. Although Americans are distant cousins of ours, they do not own a particle of relationship, or evince the slightest sympathy in the progress of our affairs, except to circumvent them as far as possible; and this they are doing with considerable success in many parts of the world. Though so young, as compared with old England, the United States are making gigantic strides in all directions; and in so doing, the Americans show that they have all the perseverance, the doggedness, and the pertinacity of the British nation, conjoined with a certain well-defined freshness of ingenuity and adaptability which we have not got to anything like the same extent. The energy which they display in all that they undertake is a feeling developed by the consciousness of possessing inexhaustible resources, and by the exuberance of a constitution which is even now only beginning to feel the strength of thews and sinews. It would be better for us English, both employers and employed, if we took a little more trouble to study the industrial position of America, with which, very few comparatively are acquainted.

Many people look upon Americans as ingenious workers who can supply us with "notions" particularly of labor-saving, or some other light and airy, character; but, except the British employer is engaged in any particular branch of business in which he comes immediately in contact with American competition, or except he is one of the very few who have traveled through industrial America with his eyes open and an unprejudiced mind, he has no idea of the scientific information, technical attainments, and keen foresight which preside over American industries, great and little. That America has already undergone great crises, such as few young countries have ever known; that she has experienced the calamity of a fearfully devastating Civil War; that she has felt the throes of financial earthquakes with extraordinary severity; that she has suffered from strikes and trade disputes, equal in extent and mischief to those of England (which is saying as much as we can say)—all these facts prove that, like an unusually strong child, she has had her "eruptions" early, and with remarkable violence; that, as a nation, the Americans are gaining their experience of life in an early stage of their history, and that all their troubles have passed over their land, leaving fewer traces behind than any other country could expect."

"Pierre A. Jodoin, iron foundry, of this city," says the Montreal *Journal of Commerce*, "fails under liabilities roughly estimated at $65,000. Jodoin bought into the business some four or five years ago. He was without experience or fitting qualifications, and it is not surprising that in undertaking to manage a foundry he has managed to founder a promising undertaking. The assignees came into possession of a large stock which has been gradually accumulating upon Jodoin's hands for want of buyers. A very large percentage of the liabilities consists of notes endorsed by Jodoin's mother, a lady possessed of an ample fortune, who will be well able to cover her son's default. The unsecured liabilities can hardly amount to $5,000, and will, in all probability, be met in full. The only ultimate loser will be Jodoin himself, who has bought his business experience at the needlessly high price of a largely curtailed inheritance. The apprenticeship system, though, on the whole, deservedly out of favor in these times, is not without its virtues, and in default of it we would recommend all who would manage a business, especially one so complex, so uncertain, and so liable to leakages as that of an iron foundry, to take practical lessons as an employee before assuming grave responsibilities."

To obtain the deep black polish on iron or steel, says the *Engineer*, it is necessary to boil one part of sulphur in ten parts of oil of turpentine, the product of which is a brown sulphuric oil of disagreeable smell. This should be put on the outside as lightly as possible, and heated over a spirit lamp till the required black polish is obtained.

The Illinois Railroad Commissioners have obtained returns from twenty-six railroad companies, which show that the "life" of a locomotive engine varies from 8 to 24 years, and that the general average is 15¼ years. Passenger cars "live" from 8 to 20 years, the average being 15¾ years; the average life of stock cars is ten years, and of freight cars 11½. Railroad bridges of wood endure from 5 to 20 years.

Akron, Ohio, is soon to have a malleable iron works.

Engineering Popularized.

No. VII.

There is something frightful this hot weather, Mr. Editor, in the thought of the AMERICAN MACHINIST as a weekly. That is to say, it is frightful from the standpoint of a luckless contributor, who is expected to toe the mark promptly every week, regardless of ——, or, in other words, his article must come forth, come Fourth, or come what will! * * * * Having mercifully allowed you to recover, I will proceed to state my grievance. It is found on page 3, of the last number. Where! *oh* where, did you get that rule for horse-power! It is in just so far an excuse that "Exchange" is responsible for it; but just see what your scissors and paste pot are going to bring you to! You are not used to those tools—don't try them!

Now, how is this for a rule: "Multiply the area of the piston by the *boiler pressure* (!) and that by the piston travel in feet per min., divide by 33,000, and deduct thirteen per ct. for friction and *condensation* (!)" Let us try it and see how it works. My engine is the conventional "30 Hoss," *i.e.* 12″×30″, runs 80 turns, and I carry 80 lbs. by gauge. Hence, area=113 sq. in.; piston travel 5×80=400 ft. Now for the rule, $\frac{113\times80\times400}{33000}=110$; 13 per cent. of this is 14, which deducted leaves 96 H. P.! *Figures* don't lie, but —— Well, the "Exchange" that concocted that rule knew just enough to suppose that because there was 80 lbs. in the boiler, there was 80 lbs. in the cylinder too. I won't insult the intelligence of your readers by saying that it takes a pretty heavy load on an engine, either automatic or throttling, to bring the average cylinder pressure up to *one-half* of the boiler pressure. It would be barely passable to say "Deduct 13 per cent. for friction, and 50 per cent. for absurdity." It might then hit the average case within 50 per cent. of facts—or it might not. And then the idea of deducting from the *power* for *condensation!* I suspect that neither "Exchange," nor anybody else, ever saw a boiler or pipe in any practical case, which would not keep the engine ploughing along with the required pressure back of the piston, in spite of all the condensation that ever took place. Condensation is quite a different matter, when you come to talk of economy, but in one sense it is actually a *gain* of power, since in automatic engines condensation implies re-evaporation, which in turn means more pressure, and hence more power than would exist if the expansion were just perfect.

The first rule given in the same article, though better, is still very crude. It says "Multiply by the average pressure," etc., which is like Mrs. What's-her-name's rule for cooking a hare. "First catch your hare," etc. First find your average pressure!—without the indicator if you can. Then too, "less 5 lbs. per sq. in. for friction" means that 14 per cent. of the power of the engine is consumed in running itself, since the average load on an engine may be taken at 35 lbs. m. e. p. Now I don't pretend to know of a personal knowledge what the exact relation is between the power impressed on the piston and that given off on the belt, because I never experimented to find out, but I don't believe the loss should be one-third of 14 per cent. If any of your readers have got any facts in the premises, now is just the time to get rid of them.

I intended some time since to discuss what "power" really consisted of, and should have done so, only I have had to stop and spar a little with some of the rest of the boys. I would like to correct that most wretched popular notion that the bore of the cylinder is the end all—and be—all of horse power. How firmly some people believe that the whole virtue of an engine—its capabilities as to driving the mill, its capacity to swallow coal and live, in short, its value to buy and pay for—is solely and totally summed up in and expressed by—what? the transverse lineal dimensions of the hole in one end of it! Confining ourselves just now to the power question, we lay down the statement that the one measure of power for any engine is its *piston displacement*, which is simply the number of cubic inches through which the piston travels per minute, and is, of course, the product of the piston area by the piston travel in inches—or more simply, for relative measurement, by the piston travel in feet. Now just as twice three are six, or three times two are six, so it doesn't matter whether our piston displacement is made up of three parts area to one part travel, or one part area to three parts travel. The power, by which I don't mean some nominal abstract term, but the actual capability to drive the shaft and do the work, is precisely the same in each case. Why! I happen to know a little engine, 8″x14″ which in special cases runs as high as 800 rev. per minute, before a probable m.e.p. of 30 lbs. Figure that up and it lands you square at 85 H. P. And yet, fellow engineers, what would be the penalty for proclaiming an 8″x14″ in open market as an 80 horse engine? And yet, it is just as actually 80 H. P., as the conventional 16″x36″, and what is more, it happens to be doing in this particular case, just about the same work that is usually done by that sized engine, and doing it well too. It wasn't two weeks ago that the superintendent of a certain concern went around to all the engine builders, I guess, in the country, and asked bids on a 20″ engine. From the Porter-Allen, at 1000 ft., down to the Smith-Jones, at 350 ft., he admitted no discrimination. His soul longed for twenty *inches*, and hang the power! The party that took the contract popularized some engineering, and sold him sixteen.

Just by way of a closing illustration of how to use piston displacement in determining power values, let me introduce my friend Brown, who has an 18″x42″ of the ancient "twice-a-week" style, say 50 rev. It is about played out, so he proposes to replace it with a modern engine of the same power. His present piston displacement figures 254×7×50=88900. He proposes to run the new engine 600 ft., hence for the same piston displacement its area must be $\frac{88900}{600}=148$ sq. in., which is about the area of a 14″ piston. Hence his new engine will likely be a 14″x30″, at 120 rev., and that is all there is to it. This rule, unlike the one first discussed, is sure fire, and may be depended upon every time.

WM. LEE CHURCH.

P. S. In the June number the types made me give 12.80 cubic in. as the steam wasted from clearance per half revolution, from a 16″ engine, showing 10 per cent. clearance. Take out the decimal, and read instead 1280, which is a much more important figure. W. L. C.

A Novel Centering Device.

Editor of American Machinist:

SIR: Careful lathemen perfectly well understand the importance of center-drilling, counter-sinking and squaring up the ends of their work if the job is one requiring any precision; but many do not see the necessity of taking this trouble, which, in many cases, is due, without doubt, to the fact that they have not studied out, or been shown, the consequences arising from neglecting these precautions.

If the end of the piece to be turned is cut at an angle, as shown in Fig. 1, and center punched or dug out with a square center as shown, then put in the lathe and the turning proceeded with, the hole will be enlarged by wear without being increased by depth, and as a consequence, the piece will wobble on the center, but what is worse, the hole will wear away faster on the side marked *a* than on that marked *b*, and so the point turned first will not be true with that turned after.

Take the same example, but with the center drilled as shown in Fig. 2. If nothing farther is done, and the piece put in the lathe and the work begun, the center will wear as shown by the dotted lines, and will keep changing to one side, and the work done last be out of true with that done first. If, when the work is half done, the end be squared off as shown in Fig. 3, the center will wear in the opposite direction, producing a piece with various degrees of eccentricity. And so too, may the same results be expected if the piece is drilled and counter-sunk and then the work proceeded with, even if the first thing done is that of squaring the ends, for then the workman starts out with his piece in the condition shown in Fig. 3.

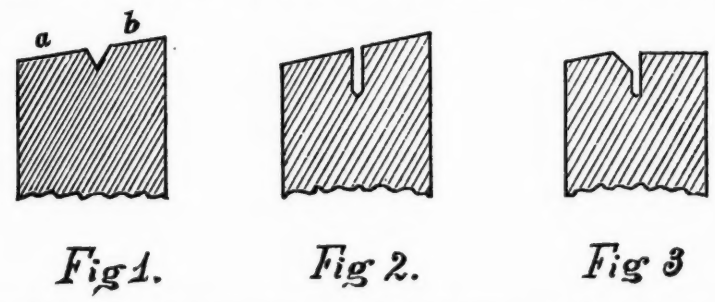


Fig 1. Fig 2. Fig 3

The only safe way is to drill the centers, then square off both ends of the piece until every vestige of chamfer worn in by the lathe centers is cut out, and then to countersink the piece. Just whether the above has been written as an apology for showing the little device illustrated in Fig. 4, or whether I have taken the trouble to show the device as an excuse for presenting the above theory is more than I can tell. Either way it is hoped that there is enough new about one or the other to pay most machinists for their trouble of reading through.

The centering device shown will be pretty readily understood from the cut without much explanation. It was made to use on the hand lever drilling machine at the Cornell University Mechanical Laboratory, which has a foot center in the platten, and it fits also the spindle of the centering lathe. The turning head or turret is a disc carrying the fine tools, two drills $\frac{5}{64}$in. and $\frac{7}{64}$in. in size with two corresponding counter-bores and one counter-sink. As 20 per cent. of the work is between $\frac{1}{2}$ in. and $1\frac{1}{2}$ in. in size, the two sizes of drills answer fairly well. Whichever drill that best suits the work is first used to drill the centers, then the corresponding counter-bore that faces off perfectly true a place about $\frac{5}{16}$ in. in diameter, and then the counter-sink. This, as it will be seen from the first reasoning, makes a perfect job. For a greater variety of work, and that of a large class, three different sized drills and one counter-bore might be used, the pin in the counter-bore from necessity being only the size of the smaller drill. With this simple device the ends of pieces can be properly prepared as cheaply as is done, but indifferently well in the old way.

JOHN E. SWEET.

Syracuse, N. Y.

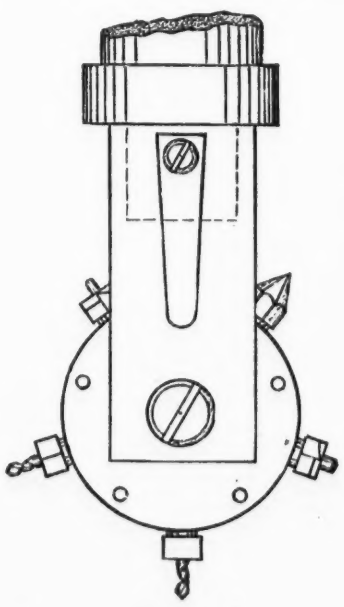
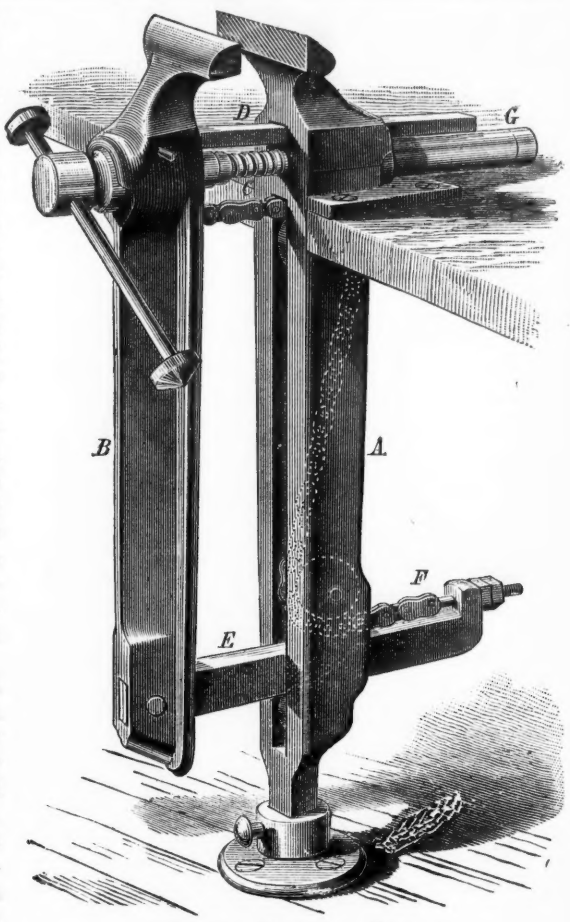


Fig 4



IMPROVED PARALLEL VISE.

An Improved Parallel Vise.

We exhibit on this page an engraving of a new parallel vise now being introduced by Pierson & Co., 24 Broadway, New York. The principal points of excellence claimed for it are: 1st, Superior workmanship. 2d, The best material. 3d, The steel bar just above the screw and moving with it stiffens the jaws of the vise and enables it to hold large or small articles with equal facility, and prevents the thread of the screw being worn or wrenched by undue sidewise pressure upon it. 4th, The chain which passes from a point directly under the screw, and over pulleys to the extreme lower end of the vise, gives additional power to the jaws and keeps them parallel, thus making it very powerful.

Its great power lies in the combination of chain and rolls.

The jaws, A B which are of the long pattern, are drawn together by the screw, C, and guided by the bars, D E, which are fixed in the jaw, B, and pass through mortises in the jaw, A. A chain, F, is attached to the jaw, B, just below the screw, and passes over a pulley in the upper part of a slot in the jaw, A, and under a pulley in the lower end of the same slot, and is provided with a threaded rod which passes through an ear formed on the end of the bar, E. By means of this rod the chain is adjusted. The lower bar, E, rests upon a roller journaled in the lower end of the slot in jaw A. The box, G, which contains an internal thread for receiving the screw, C, has a flange which drops into a socket in the back of the jaw, A, and is prevented from turning by the bar D.

When the jaws are open the chain, E, will cause the lower end of the jaw, B, to move as rapidly as its upper end, which secures parallelism of the jaws and renders them very effective.

The Battle Creek (Mich.) Machinery Co. have orders for two of their paneling and dovetailing machines to go to Moscow, Russia.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor.
HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

Edition, 7,500 Copies.

The American News Company.
Publishers' Agents, New York.

The International News Company,
(Formerly the Willmer & Rogers News Co.)
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

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The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.10 to Foreign Countries, postage prepaid.

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Inside pages, 20c. per line, (12 lines one inch.)

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☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, JULY 19, 1879.

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Our columns are open for practical correspondence from machinists and engineers, and all those interested in these professions. Write us about any good shop kinks you know about.

The Junk Shop Trade.

It is reported to be one of the familiar remarks of the irrepressible Barnum that the American people like to be humbugged. Whether Barnum was the first to discover this we will not inquire; certain it is there are scores of sharp-witted fellows in every line of business who act apparently upon the same faith as that expressed by him. The machinery trade constitutes no exception to their operations, for in it are a class of men—respectable and respected as a body like the great showman himself—who flourish upon the credulity of their customers.

In New York and every other large city there are a number of junk shops styled "second-hand machinery depots," where a collection of all the old banged-up and cast-aside steam engines, boilers, machinery and tools that can be obtained from all the shops, storehouses and old iron yards within reach, are spread out with the invitation to passers-by to purchase. These shops, as a rule, are not run by impecunious individuals who are forced to sell at a sacrifice to obtain ready cash, however much their appearance may give this impression. There is a large profit in the business, the amount in each case depending on the customer's knowledge of machinery and his depth of gullibility. A stranger looking for a bargain in pulleys and shafting would probably come across half a dozen of these old junk shops to every rightly named machinery depot where good new and second-hand tools are sold. It does not require any considerable expense to prepare the old trash for market after it is once secured. The rust is carefully scraped off, perhaps a few broken bolts replaced with new, the most attractive parts rubbed up with sand and emery paper, and other parts overlaid with a coat of fresh paint.

An old boiler is cleaned out inside, two or three of the most shackly tubes taken out and replaced with others from a broken-up boiler that look better, the most leaky spots patched and the others (inside) puttied up, a new safety valve attached, and a genteel coat of red paint spread over the shell The boiler is then ready for sale as "only a little used" at John Smith's tannery (where it went in third-handed) and "carefully inspected, overhauled and repaired." It is bought by some innocent steam user, who knows hardly anything about boilers beyond the price asked for them, and if by good fortune it does not explode and destroy several lives, it at least, causes an extra expense and annoyance so long as it is kept running, by reason of repairs and waste of fuel. But a small proportion of machinery buyers are well qualified to judge what a machine is worth before they make the purchase, and they usually reject the advice of some disinterested party who does know. These men will not pay $400 for a lathe when they can get one of the same capacity for $125. They know too much for that! Well, in due time, they pay for their experience, but it does not always make them wise; if it did, the junk shop business would not thrive as it does. Dealers in junk machinery do not seek trade among competent machinists (gentle reader, you will look in vain for their announcements in the AMERICAN MACHINIST), but among those who know little or nothing about the operation of machinery. A few lines in a morning paper offering great bargains in second-hand boilers, engines, shafting and tools will often attract the kind of customers they desire, and the unskillful purchaser once inside of a junk "emporium" would sooner be dismissed from a Chatham St. clothing shop without investing his money than from one of these.

A sign may be made very expressive; often it is more enticing than the goods within the store. Junk shop managers recognize this and act accordingly. You will often see the most taking machinery signs painted over the whole front (and side too, if exposed) of a junk depot, and the passer-by is confronted, in big letters, by "machinists' tools, vertical engines, horizontal engines, portable engines, hot air engines, boilers, wood-working machinery, shafting, pulleys, hangers, lathes, planers, drills, blowers, saw-mills, sausage mills, steam gauges, flue brushes, &c., &c." If the enterprising proprietor has not in stock the particular machine a caller wants he will always furnish it upon short notice.

The junk shop merchants of different cities seem to co-operate, and thereby keep the run of gullible customers. Some of them club together and issue a pamphlet with an astonishing long list of second-hand tools and machines offered for sale. These they scatter liberally among probable customers for junk.

We have seen some of their more pretentious publications provided with a newspaper caption, The Machinists' Monthly, The Tool Trade Tattler, or some other attractive name. Even experienced machinists are occasionally puzzled by such publications. The manufacturers of machinery have found this junk trade a serious annoyance to their business, for only a limited proportion of buyers will become informed as to the actual value of old rubbish compared with new machinery. The same old stuff is sold over and over again, but it is always "second-hand" when in the junk shop.

Parties not thoroughly qualified to judge should take advice from some competent machinist before making their purchases, especially when about to obtain second-hand tools.

What is a Ton?

In the school arithmetics from which boys, who are to be the business men of the future, are acquiring the basis of their commercial education, the ton is explained to be of two kinds, viz.: the "short ton" of 2,000 pounds, and the "long ton" of 2,240 pounds. The latter is further explained as in use only for weighing coal (in bulk), iron and a few other particular commodities, the former being the regular ton weight recognized in commerce. But, this being the age of improvement, the ton must needs be altered to suit modern, moral and material progress. In some cases it is made shorter, as, for instance, in selling coal at retail, and in others it is made longer, notably, in paying workmen for mining coal.

Like the projectors of all other important improvements those taking the lead in applying their genius to making a better ton weight must meet with obstacles. This time it is Messrs. Tiler & Levy, proprietors of a colliery at Wiltonborough, Pa., who, says a press dispatch "have raised the standard from 2,400 pounds to 2,700 pounds a ton." The result was their miners went on a strike, not being sufficiently educated to take in such a radical improvement all at once. "The miners," continues the dispatch, "say they will not resume work until it is again reduced to 2,400 lbs., and the operators seem equally determined to resist the claims of the men." Should the solid determination of the operators and the necessities of the workmen result in full recognition of the new ton weight at Wiltonborough, and this be followed by the other mining towns of Pennsylvania, we may look for a second raising of the standard by three hundred pounds in a few months, thus making the ton an even three thousand.

Of course a State law fixing the ton weight would interfere with an occasional raising of the standard in the coal mines, and thus operate as a check to improvement; but as the operators desire nothing of the kind, and a dozen or so of them have great influence at the seat of government, no such law is likely to be passed.

We regret to see the publishers of school arithmetics so far behind the times as not to give full information of the various ton weights. They should each get out a revised edition without delay, and among the tables of weights and measures should have one specially for coal. It might begin "2,700 pounds make one ton for the miner," and go down through the varying scale of ton weights, 2,400 lbs, 2,240 lbs., &c., until the last, which should be "1.840 to 2,000 pounds make one ton for the consumer." Upon second thought we will not urge publishers hastily to this course, as the standard may be raised at one end and lowered at the other before they could get an edition through the press. Wait and see how the new improvement works.

It is wise in these sultry summer days to obtain as much physical comfort as possible while carrying on regular work. Those whose occupation requires them to bear the hot and stifled atmosphere of a shop where hardly any natural draft of cool air is obtainable, will find it worth the pains to create an artificial breeze. This can be done where shafting is kept in motion by rigging up a simple fan attachment between pulleys. There is, in most cases, room enough for one to two feet swing between shaft and ceiling, and the fan may have either one, two, three or four arms constructed of sheet metal, wood or pasteboard, and may be keyed, clamped or tied to the shaft. Two arms are generally sufficient. The apparatus need cost but a trifle, and is worthy of adoption where cooling breezes seldom are felt, as, for instance, in many shops of our large cities. Employers can, in this way, add materially to the comfort of their workmen.

A New Industrial Exhibition.

Some four months ago a number of the leading manufacturers of New England joined themselves together and obtained a charter for the incorporation of an association, under the name of New England Manufacturers' and Mechanics' Institute, "for the purpose of the general improvement of the manufacturing and the mechanical interests of New England; to provide means by which worthy and adequate exhibitions of manufactures and other productions can be given and connate objects; to obtain and distribute information relative to export business; to create and regulate methods of industrial education; to improve the technical knowledge of the members of the society by libraries, technical lectures and discussions, and to provide proper ways and means by and in which these things can be accomplished."

Working for the attainment of such commendable objects as these, the movement should receive the cordial support of all enterprising business men, and, as the plan proposed is co-operative, each individual will be helping himself while helping the business of the society.

It is proposed to erect an exhibition building in Boston, and hold an annual fair, beginning the first Wednesday in September, as soon as sufficient funds have been raised to accomplish this object. The plan is to organize a more liberal and well arranged exhibition than those heretofore held in that section of the country. New England certainly ought to make the most instructive and valuable display of manufactured goods at an industrial exhibition, and if this society meets with the success that seems to await it, such a display will be a fixed fact every year. The executive committee have issued the following circular, which has been sent to a large number of business houses throughout New England:

"We desire to call your attention to the fact that a number of gentlemen, engaged in the manufacturing and mechanical interests of New England, have formed an Association and obtained a charter of incorporation, under the above name, for the purposes enumerated in the subscription paper herewith sent.

"The distinctive aim of this association is to provide a permanent exhibition building, in which the manufacturing and mechanical interests of New England can be fitly represented, and worthy exhibitions of its products be made. This is the principal reason underlying the enterprise; but we shall meet a fortune entirely different from that which has attended analogous exhibitions, and one which is not suggested by the temper of the American people, if we do not make this a marked financial success.

"A fair will be held as soon as a suitable place and adequate funds can be procured, and thereafter every year—commencing on the first Wednesday in September.

"We wish no local, partial or narrow association, but one founded on broad principles, open to all industries, and exclusive of none; in short, we intend to make this the leading exhibition of the country. Thus managed we feel confident that the association will prove a great stimulus to New England industry. Its annual fairs, at fixed and stated times, will soon become advertised throughout the world; buyers from all states and nations will be attracted to them; for nowhere else can they see more or judge better than at a well-conducted exhibition.

"Believing that they who will be exhibitors should be sharers in the management and benefits, the executive committee have decided, before accepting offers to take stock elsewhere, to give an opportunity to the manufacturers and mechanics of New England to secure shares in the enterprise in co-operation with each other.

"We estimate that if one thousand manufacturers and mechanics of New England shall take one hundred dollars worth of stock apiece, our object can be accomplished; and we think that this would be the most generally satisfactory way in which to accomplish it.

"We therefore ask you to drop us a line—by enclosing one or the other of the accompanying blanks, with your signature, in the envelope herewith sent you—in answer to the question: 'Do you wish to embark with us in this enterprise?'

"Should you desire further information you can obtain it by inclosing your request therefor in the envelope referred to."

We learn that the above circular has thus far been well responded to, and that the prospects are very encouraging. The shares of stock are $25 each, and it would be a good investment for every prospective exhibitor to subscribe in proportion to the extent he wishes to be represented at the fair. Some may contend that there are industrial exhibitions enough already. So there are, in number, if that is all that is required to satisfy the public, but where has there been at any of these annual exhibitions a good representative display of the mechanical productions of New England? Until this becomes an accomplished fact every enterprising manufacturer in that section should use his best endeavors to have such a display brought about. The most effectual way to do it is to aid the New England Manufacturers' and Mechanics' Institute, which is projected by leading public-spirited citizens of integrity to carry out the plans laid open in their circular which we quote.

Useless Inventions.

It has been said that this is pre-eminently the age of invention, and not of literature or of art. However that may be, if the prevailing effort of any age may be so likened, the multitudes who fail of success may, perhaps, be not inaptly compared in number to the drops of water in a vast river, while the few who succeed are like the ships which sail upon that river, displacing many and borne up by all of the myriad drops below.

True it is, that to any one who will examine the records, the conviction comes that invention in our day is a lottery, in which the blanks are many and the prizes are few.

Witness, from week to week, the official reports of the Patent Office, containing descriptions of twenty worthless inventions for every one possessing practical value.

But, after all, it is only the inventor of that which is useless, even if mechanically successful, who fails utterly, because, in his case, failure derives no sense of compensation from the thought that it was a noble game, earnestly played.

Whether it be that to too many who possess inventive skill nature has denied the far more valuable gift of practical ability, or whether, in most cases, the loss of time, money and effort involved in these abortive inventions is due more directly to willful self-deception or lack of thought, certain it is that every year enough inventive skill goes to waste, and worse than waste, in this country to put a new phase, if rightly applied, upon the mechanical conditions of even this mechanical age.

Hundreds, or, more correctly speaking, thousands of men possessing the real genius of invention are to-day depriving themselves and their families, if not of bread, at least of the comforts and constantly improving prospects that might be theirs, if, before wasting their lives upon chimeras, each would stop long enough to ask himself thoughtfully: "Suppose it can be made to work, what is it good for? What will it do?"

And these are precisely the questions which the hundreds of patent agents and solicitors, whom these myriad inventors are daily consulting about their inventions, most decidedly do not ask nor encourage, their interest, and in too many instances their effort, being simply to *get the patent*, whether it covers anything or not.

To the reflective mind, therefore, following out this view, the noise and blare of trumpets, which interested parties are constantly making, regarding the great and increasing number of patents that are being issued, becomes rather saddening than otherwise, from the thought of this inevitable waste that is so rapidly converting the Patent Reports into a chronicle of failures, and the office itself into a cemetery filled with still-born inventions.

The unsuccessful effort of the inventive mind, reaching out in dumb eagerness after some perfection which lies just beyond its reach, is pathetic enough, but doubly pathetic is this grasping after shadows, this constant struggle, not for the unattainable, but for that which is worthless when attained.

Yet, for every ill there is somewhere a remedy. Clearly it would be idle to look for a remedy to those who thrive upon the evil. The remedy, therefore, from the very nature of the case, must rest mainly with the inventors themselves.

Let each inventor of useless devices think earnestly of these things; and if he cannot, so to speak, invent a genius condenser for others that will stop this waste of effort and return the spent steam to the boilers, where it can be utilized, he can at least order his own life to a better end and a more practical purpose.

The Brooklyn Elevated Railroad Co. is taking possession of the streets of that city for their unsightly iron structure as fast as they can push the work ahead. They wish to accomplish all that can be done before the rival Kings County Company come upon the arena, full fledged and ready for a contest. They are trying to get full possession of the Fulton Ferry end of the route before the litigation begins. They had a nice plan to get their men to work on the 4th: every man was paid $1 in advance to take home to his family. The plan proved a failure. Before noon the men had spent their dollars for beer, and feeling gloriously independent, quit work entirely. If the rival company wish to retard the building of a road by those first in the field, our advice is not to rely upon the slow and always uncertain operations of courts and injunctions, but to load a brewery wagon, every morning, with fresh, foaming lager beer, run it out where the railroad building is in progress, and call all the workmen to a free tap. If a persistent use of this ammunition don't create confusion in the ranks of the invaders, nothing available for prompt use will do it.

Compliments to the American Machinist.

We are much gratified by the generous recognition we have received from our brethren of the press since changing to a weekly. Complimentary notices continue to greet us every day. We copy a few of them below:

(*From the Brooklyn Eagle.*)

The AMERICAN MACHINIST, with the current issue, changes from a monthly to a regular weekly publication. The increasing success it has met with from month to month necessitates this step. Some new features are to be introduced, and the weekly is to have all the advantages of talent and liberality of business management essential to its greater prosperity in the future. The MACHINIST is published by the American Machinist Publishing Company, of New York, and it is the standard machinery newspaper of the country.

(*From the Brooklyn Union-Argus.*)

A substantial and prosperous weekly journal, entitled the AMERICAN MACHINIST, specially catering to the taste and intellectual needs of machinists, engineers, founders, boilermakers, patternmakers and blacksmiths, but possessing much information for the general reader as well, is published in New York, at No. 96 Fulton street. The most noticeable and distinctive features of this periodical are its illustrations and typography. The former are so clear that the mechanic will readily comprehend them, almost without the aid of the accompanying description, and the latter is in the best of taste, with captions and general arrangement that are alike pleasing and convenient. The MACHINIST is in a form to bind, and its preserved numbers would give an interesting history of current invention and discovery so far as mechanical matters are concerned.

(*From the Philadelphia Trade Journal.*)

The AMERICAN MACHINIST, published in New York, and one of the best mechanical journals in this country, will hereafter be issued weekly, instead of monthly.

(*From the Weekly Courant, Columbia, Pa.*)

TO MECHANICS.—The AMERICAN MACHINIST, a journal devoted to the interests of machinists, inventors, founders, blacksmiths and others, has been changed from a monthly journal to a weekly. It is quite an interesting magazine, and should be in the hands of every mechanic.

(*From the Brockport (N. Y.) Democrat.*)

The AMERICAN MACHINIST is changed this week from a monthly to a weekly publication. The general favor with which it has been received has prompted the enterprising proprietors to make this change, and it is now afforded at the price of three dollars per year. Every one interested in machinery should have it.

(*From the Labor Tribune, Pittsburgh, Pa.*)

The AMERICAN MACHINIST, a sterling publication, has changed from a monthly to a weekly issue. It is a handsome and well printed journal, and is succeeding beyond the expectations of its founders. It is published in New York.

(*From the Lock City News, Lockport, N. Y.*)

The AMERICAN MACHINIST is now published weekly instead of monthly. It is a large paper, well gotten-up, at $3.00 a year. Address American Machinist Publishing Co., 96 Fulton street, N. Y.

(*From the Syracuse Sunday Times.*)

That sterling journal, the AMERICAN MACHINIST, has shown still further enterprise by changing from a monthly to a weekly, at the same time adhering to its high standard of editorial excellence. It is furnished at $3.00 a year, and we commend it as one of the best mechanical journals. Address for it, 96 Fulton street, or order it of newsdealers.

(*From the St. Louis Journal of Commerce.*)

The AMERICAN MACHINIST, one of our most valued exchanges, has been changed from a monthly to a weekly publication. It is one of the liveliest papers in the country and is doing a handsome work in the line of its pursuit.

(*From the American Art Journal.*)

The AMERICAN MACHINIST, which began as a monthly less than two years ago, has proved so successful that the publishers have been forced to change it to a weekly. The achievement of 7,500 circulation in so short a period, notwithstanding sharp rivalry, proves that a mechanical journal, ungoverned by a clique and devoted purely to advancing the interests of its chosen field, stimulating invention, manufacture, and creating a market, is duly appreciated.

(*From the Nautical Gazette.*)

The AMERICAN MACHINIST has been changed from a monthly to a weekly publication. The change has been thrust upon the MACHINIST by the constantly-increasing pressure of important matter upon its columns.

Business Specials.

Thirty cents a line for each insertion under this head.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing, address Star Tool Co., Providence, R. I.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. S. G., Westfield, Mass., writes: I am one of those kind of fellows that likes to know everything, and a few years since I found the best way to learn it, by asking questions. What I wish to know is, How I can determine the amount of water that a pump will throw, and what course I must pursue if the water to be pumped is warm, that is, Will the pump draw it very far? A. To calculate the capacity of a pump, multiply the area of the water piston in inches by the length of the stroke in inches; this product, multiplied by the number of strokes in a given time, will give the capacity in cubic inches. The number of cubic inches divided by 231 will give the capacity in gallons. The number of cubic inches divided by 1728 will give the capacity in cubic feet. Water at a high temperature cannot be raised any considerable distance by suction. In other words, the hotter the water, the less distance can it be raised by suction. To make a pump reliable at all times for pumping hot water—the water should run to the pump.

(2) C. A. P., Newark, N. J., inquires: If you can give me a little information in reference to the invention of the ordinary D slide valve, as used on ordinary stationary steam engines, you will confer a great favor. Please answer through the columns of your paper. A. The common D slide valve is said to have been devised by Mr. Murray, of Leeds, Eng., and used by him. Reference, Dr. Lardner's, Treatise on the Steam Engine, 1840.

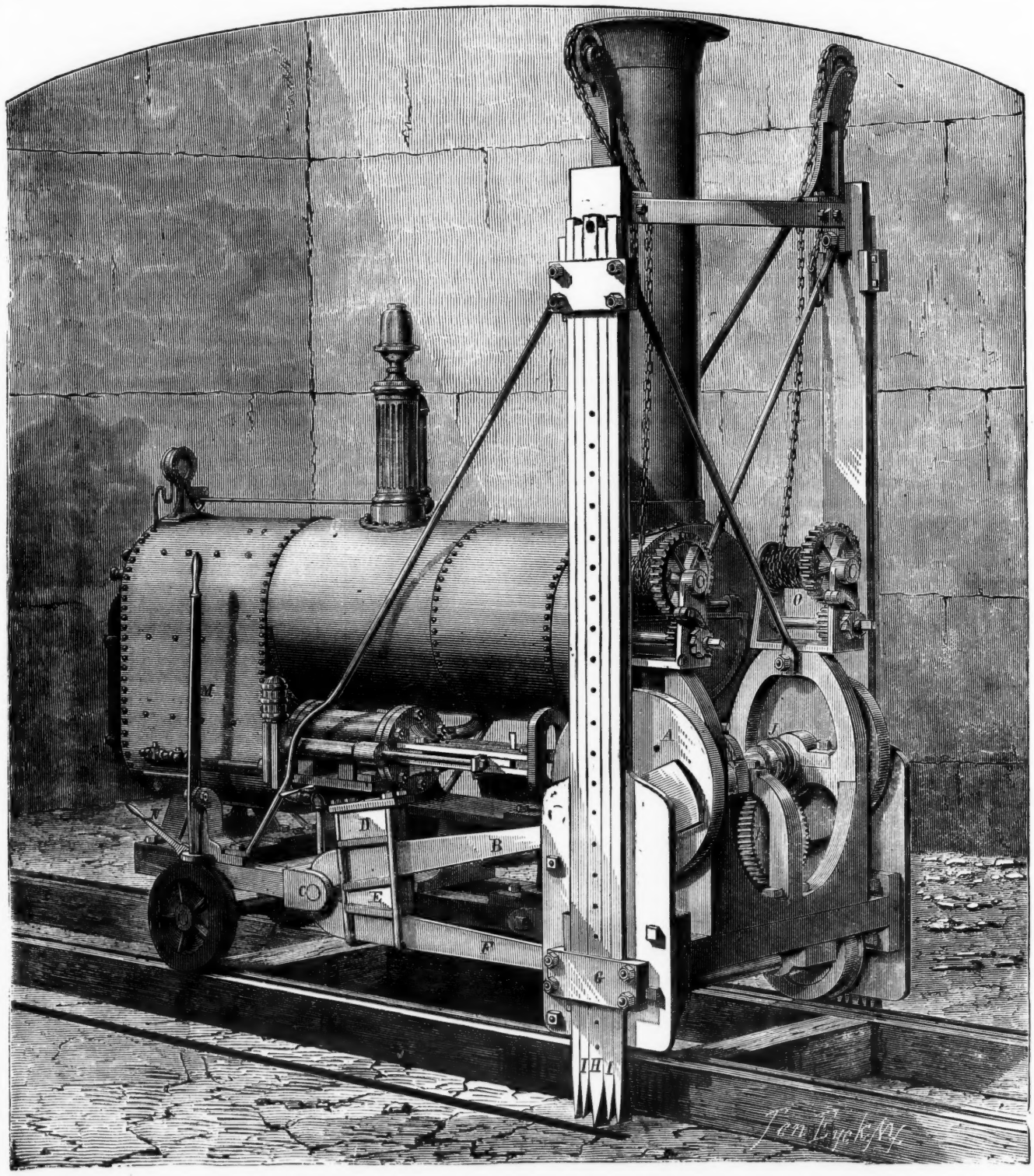
(3) C. A., Brooklyn, N. Y., writes: I have heard a great deal about the transmission of power by wire rope, and I now write to you for information. I have a water wheel located in a mill which is now in use, and I also have a large building situated about 1,000 feet from the mill, which I would like to adapt to manufacturing purposes which will require power. What I wish to know is, If it is practicable to transmit power from the mill to the large building, and also if I could use wire rope as the means to transmit the power? A. It is practicable to transmit power by wire rope, not only the distance that you speak of, but a great deal farther, and is coming into use more every year. There is an instance in the neighborhood of Frankfort-on-the-Main, in Germany, where the power of 100 H.P. turbine is conveyed for a distance of 3,200 feet, by means of a rope transmission, to a cotton factory located in the proper place for such a building. Wheels, 13½ ft. diameter, making 114 revolutions per minute, are used; size of rope ⅝ of an inch diameter. There are eight intermediate stations or places where wheels are located at distances of 400 feet apart, it being found in practice that for any distance over 400 feet an intermediate wheel, or wheels, should be used—thereby making two sections, by which the speed is much more steady. In the above instance a nearer site for a building could not be found, and this was the only way that the power could be made available for that purpose.

(4) J. C. M., Ansonia, Conn., asks: Will you oblige by informing me who first used steam expansively, or invented the cut-off? I find that there are conflicting statements in regard to this invention. A. There are no records of steam being used expansively previous to the experiments of Watt, which began in 1776, when he altered an engine at the Soho Works, so as to test the result of an early cut-off. Other trials were made, and in 1782 Watt took out a patent for certain new improvements upon steam engines for raising water, and other mechanical purposes, and gave a demonstration of the economy due to expansion, referring to a law discovered by Robert Boyle in 1662, and subsequently verified by Marriotte. It is now known as Boyle's or Marriotte's law, and is often termed the first law of the expansion of gases.

Steam Stone-Quarrying Machine.

One promising field for mechanical genius has been in devising and constructing labor-saving machines for quarrying and cutting stone for building purposes. The increasing demand for stone for building has stimulated invention in this direction, and we have the pleasure of presenting herewith an engraving of the Wardwell Stone Channeling and Quarrying Machine, which is one of the best machines of that class, and which is extensively used throughout the country. Our cut shows a double gang machine mounted upon its track on the bed of the quarry. The frame which supports the boiler, engine, and other machinery, consists of one piece of forged iron, weighing nearly a ton, thus furnishing great strength and durability. The engine is of six horse power; its shaft carrying a balance wheel A on each end, to which is attached an adjustable wrist pin plate. B and F are levers pivoted at their rear ends to the frame at C. The free end of the lever B passes through a sliding stirrup or swivel attached to the wrist pin (not shown), giving an up-and-down motion to that end of the lever, as the balance wheel A revolves. The free end of the lower lever F passes through a mortice in back side of lower clamp G. Motion is communicated from the upper to the lower lever, by means of clasps, between which the rubber springs D and E are placed as shown in the engraving. The free end of the lever F actuates the gang of chisels, which consists of five bars of the best cast steel, sharpened at their lower ends, and clamped together by head and foot clamps; the whole sliding freely on the standard. Of the five chisels, two I I have diagonal cutting edges, and three have their edges transverse. The middle chisel H extends the lowest, and altogether from a stepped arrangement each way from the center; thus it will be seen when the machine is moving forward the front three cutters, which includes the middle one, H, operate while moving in the opposite direction; the other two, with the middle one, H, perform the work. The object of the diagonal cutting edges is to insure an even bottom to the channel. These bars of steel are from seven to fourteen feet in length, according to the depth of the channel to be cut. The upper ends of these bars are separated to match corresponding separations in the head clamp, for the purpose of preventing any displacement of the cutters while in use. J is a worm on the main shaft and actuates the toothed wheel K. The shaft of the latter extends diagonally downwards to the rear of the machine, where it terminates in a bevel pinion; upon the rear axle are placed two beveled gears, one of which is shown in part at L. By means of the lever M, either of these beveled gears may be thrown into action with the pinion. It will be readily understood that the motion thus communicated serves to turn the axle either backward or forward, according to which wheel engages the pinion. When the machine is required to be stationary, these beveled gears are so placed as not to engage with the pinion. The short lever N, locks these beveled gears in either of the desired positions. The windlasses, OO, on each side of the machine, are for raising the gangs of cutters out of the channels. The opposite side of the machine is, of course, the same as they are already described.

The length of this machine is ten feet, and it is made to cut channels, either 4 feet 1 inch, 6 feet 3 inches, or 6 feet 7 inches apart, and cut two channels at once. It has a six-horse horizontal boiler and engine. The machine is locomotive and cuts moving in either direction and is reversed without stopping. Either one or both cutters may be operated at pleasure. When in use, the machine requires three men, and cuts from 75 to 150 square feet of channel in marble and limestone, and 150 to 200 in sandstone per day. It is claimed to do the work of fifty men. These machines are constructed by the Steam Stone Cutter Co., Rutland, Vt., under the immediate supervision of Geo. J. Wardwell, the inventor, who has given his exclusive attention for over sixteen years to this one object of quarrying stone by machinery.



WARDWELL DOUBLE-GANG STONE QUARRYING MACHINE.

Incrustation and Scale in Boilers.

Of compounds and devices for the prevention of incrustation or scale in steam boilers there is no end, and a great many of the manufacturers of these compounds, in most cases, disregard the chemical properties of the substances existing in different waters, which, through evaporation, go to form a deposit.

Incrustation is composed principally of sulphate of lime, carbonate of lime and carbonate of magnesia. The nature and hardness of the deposit depends upon the kind and proportion of substances held in solution and suspension. The following may serve as an analysis of ordinary hard water scale:

Sulphate of lime	56 49
Carbonate of lime	11.11
Carbonate of magnesia	19.77
Oxide of iron and alumina	.69
Silica	3.81
Organic matter	6.51
Water	1.62=100

A good filter is very essential, as in muddy water, where substances are held in suspension, but of no value where the substances are held in solution.

When waters containing any or all of the above scale-producing constituents are boiled, carbonic acid is expelled and the carbonates are deposited, and, if there be present much of the sulphate of lime, hard scale is formed. Scale causes loss of heat and power for the following reasons: The conducting power of iron is about 30 times greater than that of compact scale, and hence a great deal of heat is lost by the incrustation being allowed to attain any considerable thickness. The heat lost may be calculated by Nystrom's formula, as follows: Let t equal thickness of scale and H the per cent., then

$$H = \frac{t\ 2}{30 + t\ 2}$$

Example: Suppose a boiler of 50 H. P. consumes 4 pounds of coal per hour, per horse power, or 2,000 pounds per day. Now, if scale be allowed to accumulate to the thickness of $\frac{3}{16}$ of an inch, this would entail a loss of

$$H = \frac{3^2}{30 + 3^2} = 23.07 \text{ per cent., or } 416.40$$

pounds per day, or 46.14 per hour. This is equal to 11.53 H. P. This loss of heat also reduces the capacity of the boiler. Thus, if a boiler having a capacity of 50 H. P. when clean, and working up to its full limit, be allowed to become incrustated to the thickness of $\frac{3}{16}$ of an inch, its working capacity will be reduced to 38.47 H. P.

Another loss may be mentioned—the cost of repairs from the burning out of tubes and crown sheets, and joints becoming leaky from unequal expansion and contraction.

Scale in a boiler is dangerous, because, it being a poor conductor of heat, the danger of explosion is augmented from the metal becoming much weakened by overheating, and the water coming in contact with the intensely heated iron, by reason of a portion of scale becoming suddenly detached from the boiler by unequal expansion. For it must be borne in mind that scale does not deposit uniformly, and is usually heaviest where there is the greatest amount of heat. The reasons are now obvious why scale should be prevented. All waters except rain or distilled have more or less scale-producing constituents, and, as stated before, it is the proportion of these that determines the quality known as hard or soft.

During the past few weeks our attention has been directed to a compound known as Downer's Anti-Incrustation Liquid for prevention and removal of scale in boilers, and, from observation and investigation, it is believed to be a thoroughly chemical preparation, and is doing its work in a very satisfactory manner. The manufacturer guarantees it is not injurious to the iron or other metal, which is the most essential point. It seems to have a strong affinity for earthy salts contained in water, which makes it impossible to act injuriously on iron. It is adapted to all waters, being thoroughly effective, so far as we can learn, in those containing the largest amount of scale-producing constituents. When used in proper quantities in new or clean boilers, it is claimed to be next to impossible for scale to form for the reasons above given.

The only known way to prevent the incrustation in boilers is by chemically destroying the affinity existing between the scale-producing constituents of the water, and causing them to deposit as a sediment that can be readily washed out. This compound, which is a dark-colored liquid, when introduced into a boiler, begins its action on the water at once, after which all the

strength left goes towards loosening the scale already deposited on the inside of the boiler. It causes a precipitation of the scale-producing substances contained in the water in the shape of a powder or soft mud, which can readily be washed out.

The inside of boilers in which this compound has been used for several years has, as we have observed, a dark, glossy appearance and no indication of any destructive action of either scaling or corrosion. This compound is manufactured by A. H. Downer, No. 17 Peck Slip, New York.

LITERARY NOTES.

TEXT-BOOK ON THE STEAM ENGINE. By T. M. Goodeve, M. A., Barrister at Law, Lecturer on Applied Mechanics at the Royal School of Mines, Anthor of the Principles of Mechanics, The Elements of Mechanism, An Abstract of Patent Cases, Etc., Etc.; 12 mo. Cloth. Price $2. Published by D. Van Nostrand, 23 Murray and 27 Warren Streets, New York.

The above work is new and contains 296 printed pages, is divided into eight chapters, with an appendix. The first chapter begins with an account of the progress of the steam engine, extending back only to the period of Newcomen and Watt, when the statement that heat was a material substance was almost universally accepted as being true. The work then takes up the lectures of Black, which were delivered at the University of Glasgow, in the year 1757, giving liberal extracts therefrom, explaining his experiments and theories concerning heat, also the conflicting statements of other authorities in reference to latent heat, which extend down to the present day.

The theories in reference to the measurement of quantities of heat by the thermometer were swept away entirely by Black's experiments. The author then goes on and ventilates the speculations of different authorities as to the invention of the steam engine. Then follows a review of the discovery and improvements in the steam engine, beginning with the patent granted to Savery, dated July 25th, 1698, and passing on to Newcomen, recording his experiments, thence to Smeaton; also the experiments of Watt, and the discovery of the separate condenser, with an illustration of the Newcomen model. Watt's plan of the indicator and its application to determine the power of his engines is fully described; also theories in regard to the expansion of steam.

Hornblower's first principles of the compound engine are explained, together with Watt's apparatus for determining the power and duty of his engines. There are some useful quotations from the experiments of Regnault, for determining the pressure of the vapor of water. Chapter 2 is devoted to heat as not a material substance, showing the arguments that have been used against this theory, and describing numerous experiments on its practical application to the steam engine.

The Adiabatic Curve, which has been a mystery to many engineers, is fully explained, together with the calculations necessary to determine its form, and illustrated by diagrams. Chapter 3 is devoted to heat engines, describing the conditions necessary to economy, with the modern theories of the application of heat to produce motion. Chapter 4 treats of the conversion of motion, describing the different kinds of motion and their application.

Chapter 5 treats of the Indicator, details of construction and application, describing the duty and H. P. of the steam engine as represented by the indicator diagram, and is exceedingly plain. Important improvements in the indicator are pointed out and illustrated.

The remainder of this chapter is devoted to the action of the valves, describing and illustrating all the principal ones now in use, closing with an analysis of the indicator diagram and the laws of expansion.

Chapter 6 contains a treatise on boilers, describing the patterns generally used, comparing the early practice with that of the present day, and quoting some of the vagaries existing among engineers. There are some valuable calculations in regard to the strength of boilers, riveted seams, stays, etc., also a description of the fittings of a boiler, and the economic use of fuel.

Chapter 7 is on Compound Engines, and is illustrated by numerous engravings, showing the progress made in this direction since the first invention of this principle.

There are some drawings of the engines constructed by Messrs. Maudslay, Sons & Field, for the White Star Line of mail steamers now running between Liverpool and New York, showing a section of the same, and closing with a description of the surface condenser, with diagrams.

Chapter 8 contains an amount of miscellaneous information and details, such as steam engine governors, injectors, and the link motion, with formulas.

The Appendix contains a series of examination questions, in which there is a vast amount of information for those who expect to be examined before a board of engineers.

The chief object of the author has evidently been to point out the influence which the change in our views as to the nature of heat has exercised in the practical construction of the steam engine, and he has further endeavored to show the manner in which Watt's "diagram of energy" has enabled us to accomplish a scientific analysis of heat engines generally, and in particular, of the steam engine under all its varied forms and conditions. The book is well printed, in clear type, and is well calculated to fill the place of a text-book, besides being generally useful among practical machinists and engineers.

ILLUSTRATED CATALOGUE OF STATUARY, FOUNTAINS, VASES, SETTEES, ETC., FOR PARKS, GARDENS AND CONSERVATORIES. Manufactured by the J. L. Mott Iron Works, 90 Beekman St., New York. Price $5.

We are indebted to the above establishment for a copy of a large quarto volume, embellished on every page with fine engravings of the choicest works of art in iron and bronze, all manufactured at the J. L. Mott Works in this city. There are hundreds of elegant statues, vases and fountains represented on these pages, and the volume itself is a rare work of art which deserves a place in any family library.

All the designs shown in the book are original and patented. Considering the great expense in getting up the catalogue, a nominal price is asked for copies.

A Large Steel Contract.

The Brooklyn Bridge trustees held a meeting on July 7, for the purpose of awarding the contract for the iron and steel required for the suspended superstructure of the bridge. After an extended discussion, the following resolution recommending an award to the Edgemoor Iron Company was offered:

Resolved, That it be recommended to award the contract for the iron and steel for the suspended superstructure to the lowest bidders, the Edgemoor iron Company, according to their bid on condition that the Trustees shall not be obliged to receive or pay for more than about five hundred tons of steel during the year 1879, and shall not be required to receive any such material after the 1st of January, 1880, and in case no notice shall be given before the last mentioned date by the said Trustees to the said Company to furnish the balance of the material under the said contract, then, and until the 1st of July, 1881, the said contract may, at the option of the said Company, be determined, and no longer obligatory upon the parties, and after July, 1881, either party may cancel said contract.

The specifications for the contract require 10,728,000 lbs. of steel, and 34,000 lbs. of iron work for the suspended superstructure.

Several communications from Chief Engineer Roebling were read. These documents had been printed in pamphlet form by an order of the Board at its last meeting. In a letter to the President, on May 29, 1879, Mr, Roebling says that the lowest bid of the ten he has canvassed is from the Edgemoor Iron Company, and he congratulates the Board on the fact. He adds:

When the change from iron to steel was first contemplated I had supposed that the difference in price would be at least $100,000, but I am extremely gratified to find that the lowest bid for steel exceeds the accepted bid of last year, for iron, by only about $4,000.

It is interesting to examine Mr. Sellers's second tabular bid, because it shows that an increase in strength is invariably accompanied by an increase in price and a decrease in ductility, and consequently in its value as a structural material The difference between the lowest bid, which is in exact conformity with specifications, and the lowest bid for crucible steel, is the large sum of $364,000.

In a letter of May 31, in response to a verbal request that he should amend the canvass of the bids for steel, so as to give crucible steel bids such benefit of a reduction of weight as the increased strength of the material would permit, Mr. Roebling refuses to assume the responsibility of, in any way, reducing the sections of the superstructure, and says that, on account of the danger of rust, it would be folly to make most of them any thinner than they were fixed in the specifications. A rough estimate showed him that not more than fifty per cent. in cost could be saved by an increase of ten per cent. in the strength of the material. He adds as his last sentence to this letter: "I wish it understood that I have written my specifications in the interest of the bridge, and not in the interest of any particular contractor."

It was stated by one of the trustees, that a satisfactory test would be made of every piece of steel placed on the bridge, assurances to this effect having been received from both Col. Paine and Chief Engineer Roebling.

After some further discussion the resolution of the Executive Committee was approved by a vote of 15 to 1, and the contract was awarded to the Edgemoor Company.

Machinists' and Engineers' Supplies.

The lull caused by the three successive holidays intervening since our last issue has not yet passed away, many dealers being out of town. Boiler Iron firm, with an upward tendency. Machinery and Tool Steel in good demand and prices unchanged. Boiler Rivets remain steady at 3½c. per lb.

Pierson & Co., 24 Broadway, New York, publish the following price list for their patent Parallel Vise for Blacksmiths' and Machinists' use:

Eight Inch	$28.00
Six "	21.00
Five "	17.00
Wheelwright's Vise (with interchangeable iron and wooden jaws)	15.00
Pattern Maker's Vise	10.00
Cabinet Maker's Vise	10.00

The manufacturers of Rubber Supplies have adopted a uniform price list, to take effect August 1st, unless further amended by the meeting which is to be held July 23d. This list makes an average reduction throughout of about 30 per cent. from the old list. It is not believed that a combination will or can be formed, owing to the number of small manufacturers throughout the country who find it necessary to make little reductions from time to time in order to sell goods. When the prices of Rubber Goods are finally settled we shall notice them further.

Frasse & Co., 62 Chatham Street, New York, are daily expecting to receive a large shipment of Foot Lathes, of a new pattern, from B. W. Prentiss, Worcester, Mass. Price, $125.00.

Frasse & Co. have recently accepted the agency for the Twisted Drills made by the New York Twisted Drill Co.

Walton Bros., 19 Dey Street, New York, have brought out a new Candle Holder and Reflector for shop use, price $2.00 each. This firm are also bringing out a new device for applying lead seals to cars and numbering the same consecutively.

H. Prentiss & Co., 14 Dey Street, New York, are introducing a new patent raw hide mallet, designed to take the place of the soft metal hammers heretofore used in machine shops on fine work. They make regularly six sizes, ranging from 1 inch to 2½ inch diameter.

James Clunan, 1563 Atlantic Avenue, Brooklyn, N. Y., is introducing a new patent Belt Coupling, designed for leather belts, and intended to take the place of lace leather and belt hooks. Three sizes now in market.

F. S. Van Vleck, 34 Vesey Street, New York, has taken the agency for a new small tool for cutting belt lacing, with gauge attached for cutting different widths.

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

ALSO,

FILERS' TOOLS AND SPECIALTIES.

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"DOUBLE ENDER" SAW FILES,
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VISE FILE HOLDERS,
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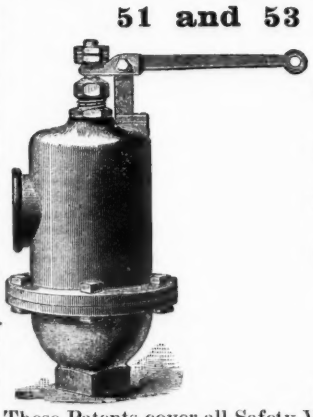
IMPROVED BUTCHERS' STEELS.

MANUFACTORY AND OFFICES AT

PROVIDENCE, R. I., U. S. A.

The Consolidated Safety-Valve Co.

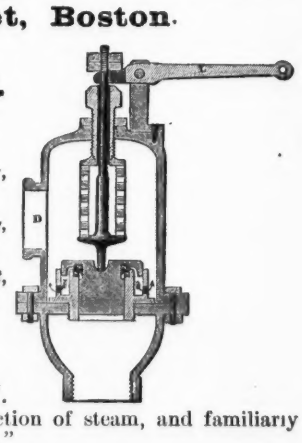
51 and 53 Sudbury Street, Boston.



Capital, $100,000.

CHAS. A. MOORE,
Pres. and Gen'l Manager,
MARTIN LUSCOMB,
Treas and Secretary,
GEO. W. RICHARDSON,
Superintendent,

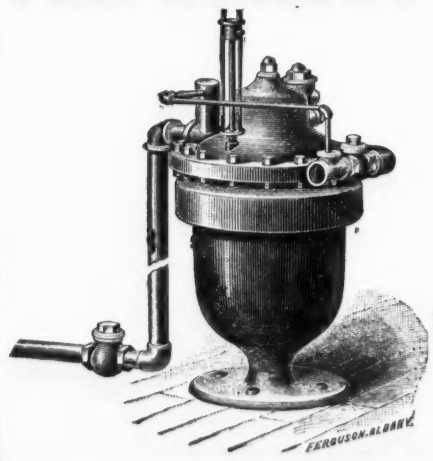
Sole Owners of all Safety-Valve Patents granted to
E. H. ASHCROFT, Boston, Mass.
AND
GEO. W. RICHARDSON, Troy, N. Y.

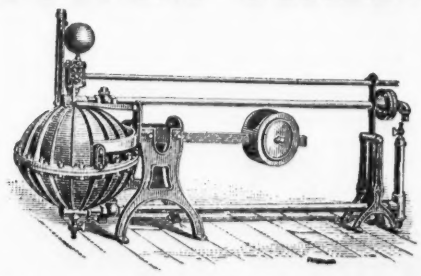


These Patents cover all Safety-Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety-Valve."

☞ *Purchasers, beware of infringements of our Patents.* ☜

THE ALBANY STEAM TRAP.





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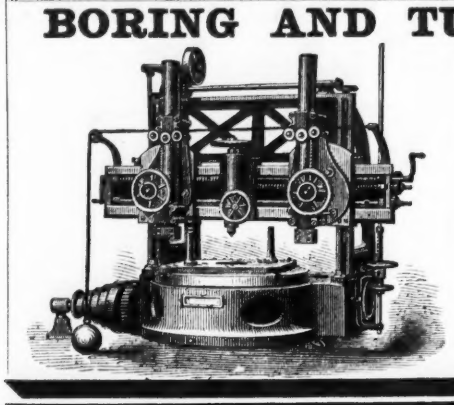

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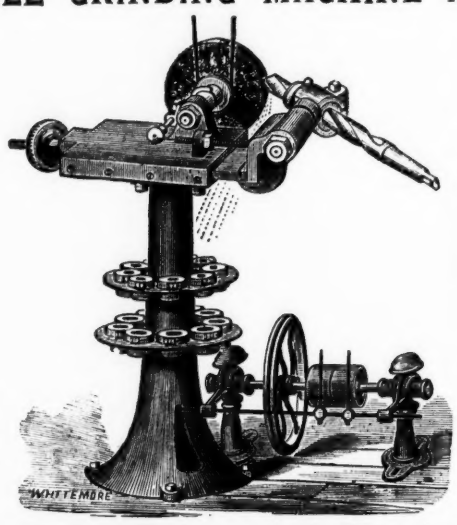

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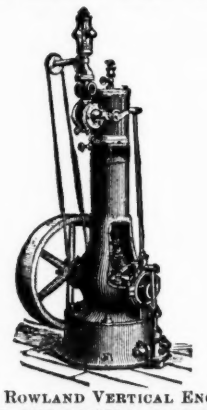

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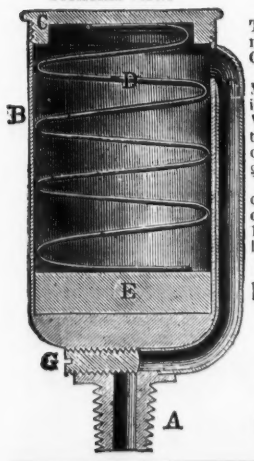

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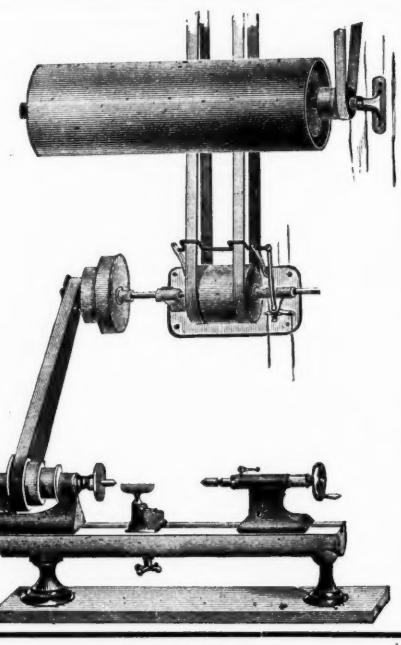

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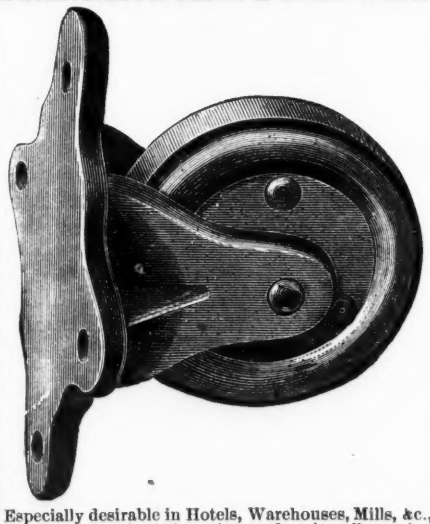

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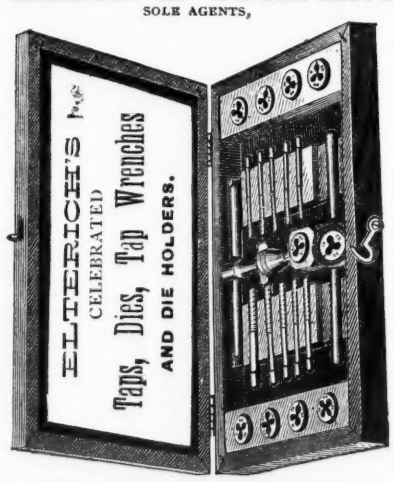

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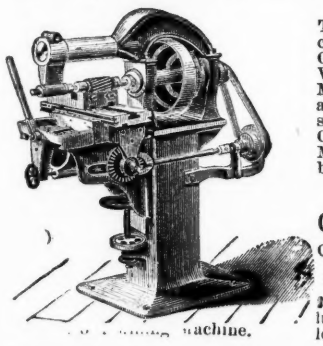

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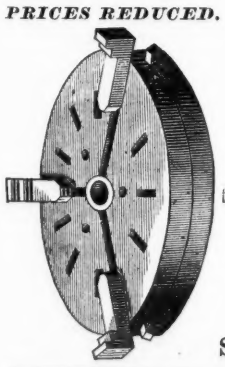

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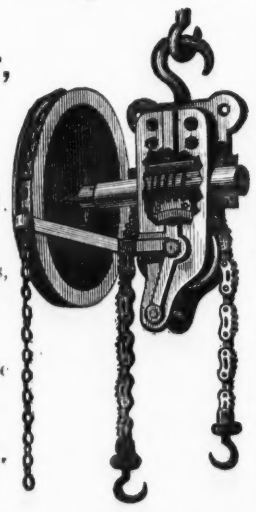

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The following original articles, by twelve of the best mechanical authors in the U. S., appeared in the *American Machinist* of the dates mentioned below. Copies containing these articles can be ordered from any newsdealer at 6 cents each.

Sizes of Safety Valves.
Prof. R. H. Thurston. December, 1877.

Methods of Setting Boilers in Brick-Work.
Theron Skeel. December, 1877.

Boiler Explosions.
Stephen Roper. April, 1878.

Strength of Steam Boilers.
John W. Hill. July, 1878.

The Properties of Water.
John W. Hill. August, 1878.

Balancing Pulleys.
Geo. M. Chordal. August, 1878.

Piston Speed of Engines.
Wm. Lee Church. September, 1878.

Composition of Fuel.
John W. Hill. September, 1878.

To Prepare a Shaft Properly for Turning.
J. J. Grant. October, 1878.

Practical Method of Setting the Valves of a Locomotive.
L. F. Lyne. November, 1878.

Boring Locomotive Cylinders.
L. F. Lyne. December, 1878.

Grinding and Polishing Metal Surfaces by Hand.
Thos. Hagerty. December, 1878.

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Engineering Popularized.
Wm. Lee Church. January, February, March, April and May, 1879.

Calculated vs. Actual Engine Duty.
W. H. Odell. January, 1879.

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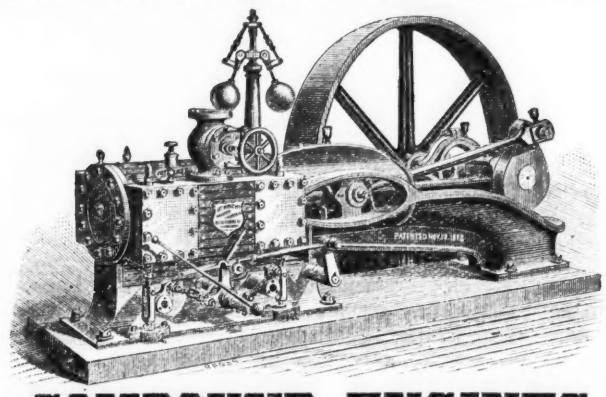

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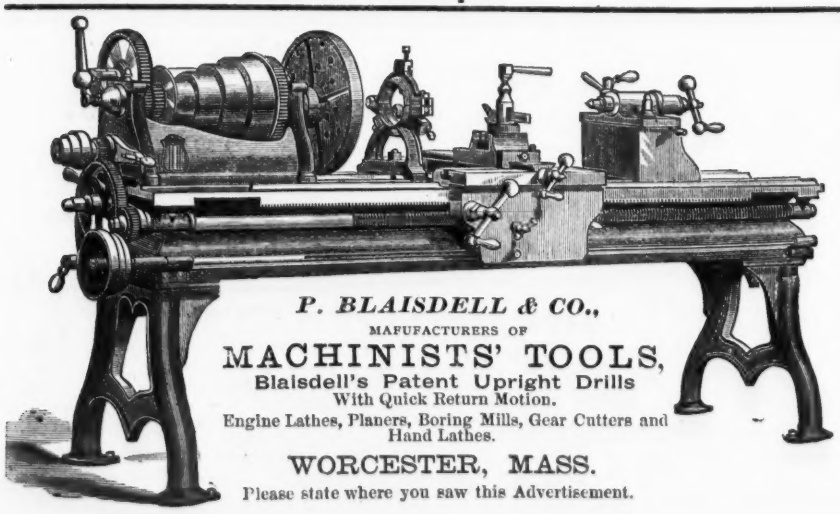

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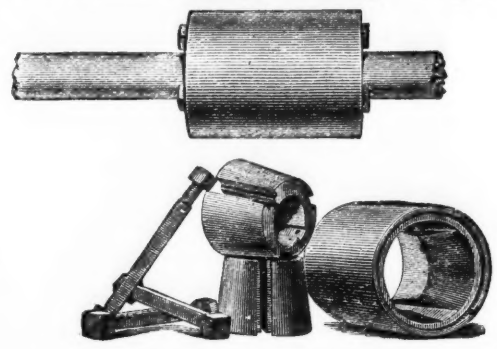

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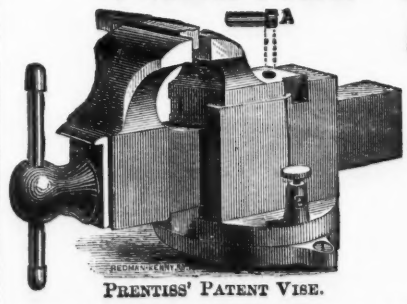

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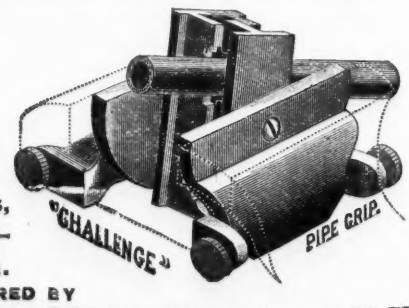

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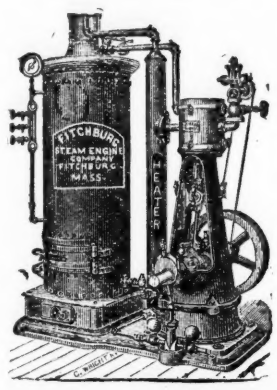

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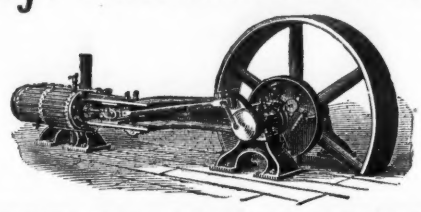

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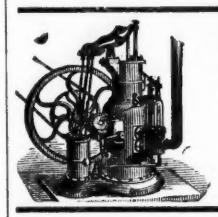

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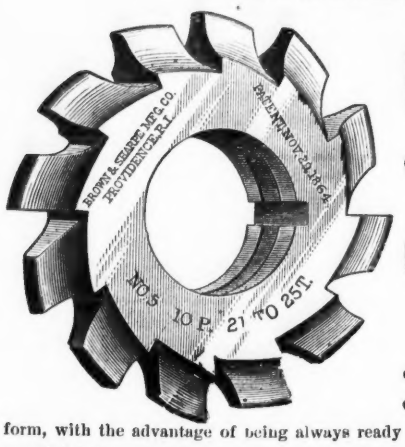

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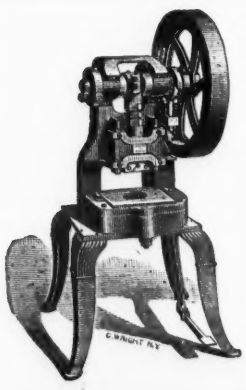

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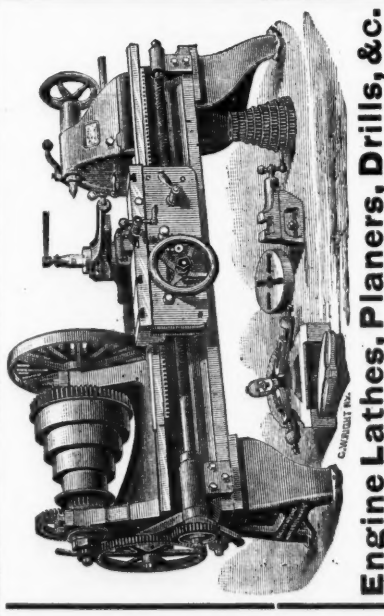

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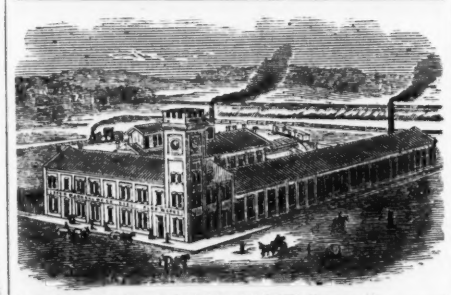

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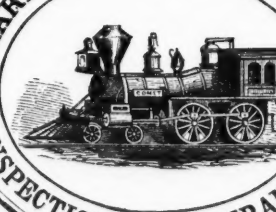

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